EFFECTS OF SMOLT LENGTH AND EMIGRATION TIMING ON MARINE SURVIVAL AND AGE AT MATURITY OF WILD COHO SALMON (*ONCORHYNCHUS KISUTCH*) AT AUKE CREEK, SOUTHEAST ALASKA

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A

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ABSTRACT

Coho salmon *Oncorhynchus kisutch* smolt were collected during the 1993 – 1997 emigrations at Auke Creek near Juneau, Alaska. Each day emigrants were separated into four size categories: small (< 90 mm), medium (90 - 110 mm), large (111 – 125 mm), and extra large (> 125 mm), tagged with a sequentially coded-wire tag, and released at tidewater. Tags from returning adults and jacks were collected and decoded in 1993-1998. Most survivors originated from the large and extra large categories, 40.5% and 43.1%, respectively. Large smolts contributed 28.9% to smolt-to-jack returns, significantly less than the smolt-to-jack survival contributed by extra large smolts, 67.8%. Smolt year, emigration date, and smolt length were significant in determining the length of returning jacks. In the 1993 and 1997 smolt years, significantly smaller returning adults originated from smolts that migrated later. Larger smolts produced significantly larger returning adults in all smolt years except 1994.

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INTRODUCTION

Marine survival and abundance of salmon (*Oncorhynchus sp*) populations vary inter-annually from the time of marine entry as juveniles to the time of their return to nearshore areas as adults or jacks. Variation in survival has been explained by size differences of juveniles at the time of marine entry. Evidence of size-dependent survival has been described for sockeye salmon (*O. nerka*, Henderson and Cass 1991; Koenings and Geiger 1993), steelhead trout (*O. mykiss*, Ward and Slaney 1988); and coho salmon (Hager and Noble 1976; Bilton et al. 1982; Johnson 1970; Holtby et al. 1990; Irvine and Ward 1989; Thedinga and Koski 1984; Shaul et al. 1991). Most evidence for a positive relationship between smolt size and survival comes from marked hatchery-raised smolts (Bilton et al. 1982, Johnson 1970, and Hager and Noble 1976) rather than wild populations. Evidence for emigration time-dependent survival has been described for pink salmon (*O. gorbuscha*, Taylor 1980; Mortensen et al. 2000) and coho salmon (Thedinga and Koski 1984; Bilton et al. 1982, 1984; Clarke and Shelbourn 1980; and Holtby et al. 1990).

Variation in survival is difficult to study in natural populations, and in particular, the information on juvenile growth, age structure, fishery effects, and life history is not available for Alaskan populations. Consistent information and complete stock assessments on Alaskan coho salmon is challenging because of the remote locations of most streams and the inclement fall weather conditions when returning fish enter spawning streams. Accurate assessment of adult escapements are complicated by the fact that peak abundance of spawners largely coincides with high rainfall and flooding often making counts impossible. Foot surveys and the maintenance of counting weirs are often not possible. Similar weather conditions during smolt migrations from freshwater hamper the collection of accurate counts and scale samples to monitor winter survival and complete age verification. With these obstacles to overcome, multi-year, long-term, and complete data collections are hard to achieve for any stock.

Auke Creek sustains a stock of wild coho salmon for which complete and consistent counts of juvenile and adult coho have been maintained since 1980. Coho smolt tagging and marking programs have been operated since 1976, with the exception of 1978. It has been used in conjunction with three other stocks in Southeast Alaska as an indicator stock for the health of the local coho salmon population. Because of the tagging program, exploitation and contribution to the Alaska commercial and sport fisheries and ultimately marine survival can be estimated. The unique ability to control enumeration and tagging procedures on coho smolts at Auke Creek, and the ability to capture adults and jacks at the weir, allowed for a detailed look at smolt length and emigration time on survival and age at maturity.

A five-year tagging study on wild coho salmon at Auke Creek near Juneau, Alaska, was implemented to observe annual and intra-annual variation of marine survival and to determine if the variation could be attributed to smolt length or the natural timing of emigration. Smolts were tagged with sequentially coded micro-wire tags (CWT) according to length and emigration date and adults and jacks returning to the stream were examined. A general description of historical data collections will be presented along with descriptions of the smolt emigration and subsequent adult and jack returns to the Auke Lake system for 1993 through 1998. The variation in marine survival, maturation age of males, and body size will be examined with respect to smolt length and smolt emigration timing.

METHODS

Hypotheses about relationships between size and timing of smolts with survival, maturation age, and body size of mature returning fish were tested by applying unique and identifying micro-wires to coho smolts emigrating in four length categories and on consecutive days during the emigration, and then observing, measuring, and counting returning fish in these length and day categories.

Wild coho salmon smolts were captured during their spring migration from Auke Lake, Alaska, 1993 through 1997, and subsequent information was gathered on returning jacks and adults. Smolts were captured at a permanent two-way fish counting weir located at the head of tidewater in Auke Creek, about 400 m downstream from the outlet of Auke Lake (Figure 1).

Emigrant smolt capture and tagging

The weir is a two-way permanent structure with the ability to capture all emigrant fish moving downstream in the spring and all immigrant fish moving upstream in the fall. The emigrant weir was operated from March 1 through June 30 each year to intercept all emigrating coho salmon smolt. During emigration, all water from Auke Creek was diverted through 5 inclined aluminum traps with 3 mm perforations. The traps spilled most of the water and diverted fish through a metal trough to a fiberglass holding tank located in a pool below the weir. Catches in the emigrant traps represented the total migration of fish from the Auke Creek system. Fish were sorted, counted, measured, and tagged daily prior to their release downstream from the weir. Stream temperatures in Auke Creek and sea surface temperatures for Auke Bay were measured daily.

All juvenile coho salmon smolt emigrating to the marine environment from Auke Creek were captured and tagged with CWTs daily. Coho salmon smolt were anesthetized with MS-222, measured to the nearest 1 mm snout-to-tail fork length (SNFL), and sorted into four length categories: small (<90 mm), medium (90–110 mm), large (111–125 mm), and extra large (>125 mm). Each day, smolts from each length category were injected in the snout with a full-length (1 mm long x 0.25 mm diameter, Appendix 3), sequentially marked CWT (Northwest Marine Technology, Inc. 1995), and externally marked with the removal of the adipose fin. The uniquely tagged groups were used to estimate marine survival of individual groups representing smolt of a particular length migrating on a particular day. Tagged fish were held overnight to check for tag retention and mortality, then released in to Auke Creek downstream from the weir. Because of the small numbers of smolts during the early stages of the migration, smolts were held until at least 50 individuals were collected for tagging.

Immigrant adult and jack capture

The immigrant weir was installed June 30 and operated through November 15 each year to capture coho salmon jacks and adults. The term “jack” is used to describe coho that mature and return to spawn within the same year of tagging, and “adult” is used to describe coho that mature and return to spawn one year after tagging. During immigration, all fish entering Auke Creek were diverted into a fish trap by vertically slotted weir panels. Perforated aluminum screens (40.6 cm x 96.5 cm) with rectangular slots (1.3 cm x 10.2 cm) were fitted to the upstream side of the weir to prevent the escape of small fish through the existing weir panels. Jacks and adults were individually handled to obtain data on return date, daily counts, and length. Stream temperatures in Auke Creek and sea surface temperatures for Auke Bay were measured daily. Coho salmon carcasses were recovered on the upstream side of the weir.

CWT sampling and definitions

Coded wire tags from carcasses were deciphered at the Auke Creek facility using the protocol provided by Alaska Department of Fish & Game (ADF&G), Division of Commercial Fisheries (DCF), Coded Wire Tag (CWT) Laboratory and programs described by Unwin et al. (1997). Coded wire tags were recovered from a subsample of jacks killed at the weir. All adults were released into Auke Creek and CWTs were recovered from carcasses collected in Auke Creek and other parts of the Auke Lake system rather than sampling live fish. Carcasses were from coho adults that had either died after spawning or by natural causes. Not all the carcasses could be collected because of the loss during floods or from scavengers that ate the fish.

In this study, total survival is the total estimated return of jacks and adults extrapolated from the tag recoveries collected in the commercial and sport fishery and at the weir, expressed as a percentage of the number of smolts tagged in a migration year. Jack survival is defined as the percent of marked smolts that returned to Auke Creek the same year of tagging. Adult survival is the percent of marked smolts that returned to the weir plus those caught in the fishery. The total number of jacks and adults in each size group captured at Auke Creek was determined by expanding the number of tags recovered by an expansion factor that accounted for the part of the return that was not sampled for CWTs at the weir. This expansion factor was the total number of jacks or adults divided by the number of tags recovered at the weir. For clarity, year, as used in this report, applies to the year of the smolt migration. For example, the 1993 smolts returned as jacks in 1993, referred to as 1993 jacks and as adults in 1994, referred to as 1993 adults, making reference to smolt year.

All of the measurements and identities of tagged coho salmon caught in the commercial and sport fisheries (season lengths, gear types, sampling regimes, geographic locations, length, contribution to the fishery and expansion of the recoveries) used in this analysis were obtained from a database maintained by ADF&G, DCF, CWT Laboratory, and collected through the statewide port-sampling program for the commercial and sport fishery. ADF&G's sampling goal is 20% of the coho catch by fishery time/area strata. The various fisheries are stratified differently: statistics from the troll fishery are stratified by troll fishing period and by fishery quadrant; statistics from the seine and gillnet fisheries are stratified by week and fishing district; statistics from the recreational fishery are stratified by port and fortnight. The ports that are sampled by ADF&G for commercial landings are in Yakutat, Wrangell, Sitka, Port Alexander, Petersburg, Pelican, Metlakatla, Ketchikan, Juneau, Hoonah, Excursion Inlet, Elfin Cove, and Craig (Craig Farrington, ADF&G, Juneau, personal communication). The ports that are sampled by ADF&G for recreational harvests are in Yakutat, Elfin Cove, Gustavus, Sitka, Petersburg, Wrangell, Ketchikan, Juneau, and Craig (Mike Jaenicke, ADF&G, Juneau, personal communication). The commercial or sport fishery recovers few, if any, coho salmon jacks, therefore survival of jacks was determined from weir recoveries.

Covariance model of smolt length and date on length of returning jacks and adults

Analysis of covariance (ANCOVA) was used to model lengths of returning jacks and adults as functions of smolt length and emigration date (Neter and Wasserman 1974, Sokal and Rohlf 1995). This was done to determine whether there was a relationship between smolt lengths, and of emigration date, to return length. Smolt length was represented by four length categories. The analysis was limited to smolt length categories and emigration dates for which tags were recovered from both jacks and adults (i.e., only emigration dates between May 10 and June 1 of each year). In models of adult return length, the small smolt category was excluded from the analysis, and in models of jack return length; small and medium smolts were excluded from the analysis because of insufficient numbers of adult and jack recoveries from these length categories. Measurements of adult length from the commercial fishery were converted from SNFL to mid-eye-to-fork of tail length (MEFL) measurements to be consistent with length measurements taken at the weir by MEFL (mm) = 0.914 x SNFL (mm) + 4.448 (mm) (Pahlke 1989).

The one-factor ANCOVA model with a fixed effect was

$$Y_{ijk} = \mu_{..} + \tau_j + \beta_k + \gamma(X_{ijk} - \overline{X}_{...}) + (\tau\beta)_{jk} + \varepsilon_{ijk},\quad i = 1, \ldots, n_{jk}\,; j = 1, \ldots, 3;\ k = 1,\ldots,5, \qquad \textbf{(1)}$$

where:

Y_{ijk} is *i*-th adult length in mm (or jack length) at the *j*-th level of smolt length and the *k*-th level of year,

$\mu_{..}$ is an overall mean length in mm,

τ_j is the *j*-th level of smolt length, j = 1,4

β_k is the *k*-th level of smolt year, k = 1,5

γ is a regression coefficient for the relation between Y and X,

X_{ijk} is Julian date of emigration,

$(\tau\beta)_{jk}$ is the interaction between smolt length and smolt year,

ε_{ijk} are independent $N(0,\sigma^2)$, and

n_{jk} is number of observations at the *j*-th level of smolt length and the *k*-th level of smolt year,

j is the levels of smolt length (where in the adult model there are 3 levels and in the jack model there are only 2 levels), and

k is the levels of smolt year.

Nonparametric bootstrapping was used to compute the standard errors for estimated parameters (Efron and Gong 1983), and Wald statistics compared to the t-distribution were used to calculate the significance of variables (Hosmer and Lemeshow 1989). The α–level was 0.05.

Multinomial model of date and length effects on adult and jack survival

Multinomial logistic regression was used to model the relationship between expanded numbers of adult and jack recoveries, and remaining numbers that did not return as a function of smolt length and emigration date. The general approach is to select one of the three (J) nominal response categories as a "modal category" and to model the log-odds of each of the other categories against that one (Hosmer and Lemeshow 1989, Lunneborg 1994). Numbers of smolts that did not return (DNR) was the most natural choice as a comparison category. This gave rise to two (J-1) logistic regressions that were fitted "simultaneously." The covariate smolt length had three levels: medium, large, and extra large. Within the model, medium was compared to large, and large was compared to extra large. The interest was to determine the effects of smolt length and emigration date on the odds of a coho returning (either to the fishery or to the weir, and as an adult or jack). Using DNR as the modal category, the model is

$$\log\left[\frac{\text{p(returning as adults | smolt length and date)}}{\text{p(not returning | smolt length and date)}}\right] = \beta_{1,0} + \beta_{1,1}x_1 + \beta_{1,2}x_2 + \beta_{1,3}x_3$$

$$+ \beta_{1,4}x_4 + \beta_{1,5}x_5 + \beta_{1,6}x_6 + \beta_{1,7}x_7 + \beta_{1,8}x_1x_4 + \beta_{1,9}x_1x_5 + \beta_{1,10}x_1x_6 + \beta_{1,11}x_1x_7 + \beta_{1,12}x_2x_4$$

$$+ \beta_{1,13}x_2x_5 + \beta_{1,14}x_2x_6 + \beta_{1,15}x_2x_7 \,,$$

and

$$\log\left[\frac{\text{p(returning as jacks | smolt length and date)}}{\text{p(not returning | smolt length and date)}}\right] = \beta_{2,0} + \beta_{2,1}x_1 + \beta_{2,2}x_2 + \beta_{2,3}x_3$$

$$+ \beta_{2,4}x_4 + \beta_{2,5}x_5 + \beta_{2,6}x_6 + \beta_{2,7}x_7 + \beta_{2,8}x_1x_4 + \beta_{2,9}x_1x_5 + \beta_{2,10}x_1x_6 + \beta_{2,11}x_1x_7 + \beta_{2,12}x_2x_4$$

$$+ \beta_{2,13}x_2x_5 + \beta_{2,14}x_2x_6 + \beta_{2,15}x_2x_7 \,, \qquad \textbf{(2)}$$

where p = proportion,

β's = coefficients,

x_1 = smolt length large, i.e. value is 1 if smolt length is large and 0 otherwise,

x_2 = smolt length extra large, i.e. value is 1 if smolt length is extra large and 0 otherwise,

x_3 = date,

x_4 = smolt year 1994,

x_5 = smolt year 1995,

x_6 = smolt year 1996, and

x_7 = smolt year 1997.

The model was fitted to data collected on smolts migrating between May 10 and June 1. Data collected before May 10 and after June 1 were excluded because there were too few returns for valid comparisons. Small smolts were excluded from analysis because this length category had too few returns of jacks or adults for valid statistical comparisons. The multinomial logistic regression was used to model the relationship between expanded numbers of adult and jack recoveries as a function of smolt length and emigration date. The number of adult recoveries was used as the "modal category" and compared to the number of jack recoveries (Hosmer and Lemeshow 1989, Lunneborg 1994). The smolt length categories and the comparisons made were the same as above. Using adults as the modal category, the model is same as described above with replacing "p (not returning | smolt length category)" with "p (returning as adults | smolt length category)".

The multinomial logistic regression model was fit with S-PLUS 6.1 (Insightful Corp. 2002) and the MASS and NNET libraries (Venables and Ripley 1999). Two sets of estimated coefficients and standard errors are reported, corresponding to the odds of returning as adults versus DNR and the odds of returning as jacks versus DNR. The "odds" of a particular response are assessed relative to the modal one and provide a measurement of association, approximating how likely an outcome may occur. The odds ratio was computed as $e^{\hat{\beta}_i}$, where $\hat{\beta}_i$ is the estimated coefficient for variable x_i. The 95% confidence interval for the odds was calculated as the following:

$$\exp\left(\hat{\beta}_i \pm Z_{1-\frac{\alpha}{2}} \times S\hat{E}\hat{\beta}_i\right), \qquad \textbf{(3)}$$

where $Z \sim N(0,1)$ and $\alpha = 0.05$.

Nonparametric bootstrapping was used to compute the standard errors of estimated parameters (Efron and Gong 1983), and Wald statistics compared to the *t*-distribution were used to calculate the significance of variables (Hosmer and Lemeshow 1989). The α–level was 0.05.

Binomial model of total survival

A logistic regression was used to model the relationship between the proportion of coho salmon returns (sum of adults and jacks as a proportion of the number of emigrants in a size group on a date) and the numbers that did not return as a function of smolt length and emigration date (Hosmer and Lemeshow 1989, Lunneborg 1994). The variables smolt length and emigration date are treated as described earlier. The model was fit to data collected from fish that migrated as smolts between May 10 and June 1 in length categories medium, large, and extra large.

The logistic model, or general linear model (GLM), fit was the following:

$$\log\left[\text{p(surviving | smolt length and date)}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$$

$$+ \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_1 x_4 + \beta_9 x_1 x_5 + \beta_{10} x_1 x_6 + \beta_{11} x_1 x_7 + \beta_{12} x_2 x_4 + \beta_{13} x_2 x_5 + \beta_{14} x_2 x_6$$

$$+ \beta_{15} x_2 x_7 , \qquad \textbf{(4)}$$

where p = proportion,

β's = coefficients,

x_1 = smolt length large, i.e. value is 1 if smolt length is large and 0 otherwise,

x_2 = smolt length extra large, i.e. value is 1 if smolt length is extra large and 0 otherwise, and

x_3 = date,

x_4 = smolt year 1994,

x_5 = smolt year 1995,

x_6 = smolt year 1996, and

x_7 = smolt year 1997.

Within the model large was compared to medium smolts, and extra large was compared to large smolts. SPLUS 6.1 (Insightful Corp. 2002) was used to fit the logistic model. Estimated coefficients and standard errors are reported for the odds of surviving and provide a measurement of association, approximating how likely an outcome may occur. Odds ratios and their 95% confidence intervals were calculated using equation 3.

In data that are over-dispersed, the variance of the response exceeds the normal variance (Aitkin et al. 1989, McCullagh and Nelder 1983). Over-dispersion is not uncommon, occurs often in binomial and Poisson data, and is considered the norm rather than the exception (Aitkin et al. 1989). It can lead to unexplained significant high-order interactions and the mistaken selection of the saturated model to describe the data. It frequently occurs in large samples when not all of the factors relevant to the response are classified and in groups where the success probability is not constant because of effects of unknown factors. It can also occur in clustered data in which observations are not independent, or when natural clustering occurs within the population (McCullagh and Nelder 1983).

Parameters describing overall dispersion were estimated for the binomial and multinomial models describing total survival and adult and jack survival for all five years (McCullagh and Nelder 1983, Aitkin et al. 1989). SPLUS 6.1 was used to estimate the dispersion parameter as the Pearson's χ^2 statistic divided by the residual degrees of freedom (Insightful Corp. 2002). For the binomial dispersion parameters, the error was assumed to follow binomial distribution while the error for the dispersion parameters for the multinomial model was assumed to follow a multinomial distribution.

Over-dispersion in the Auke Creek data was expected for at least two reasons. First, it would be unreasonable to expect that every factor relevant to the survival response was identified and measured. Second, there are natural and artificial levels of clustering that would play a role in increasing variance. Naturally occurring clusters within the population could have included freshwater age class, smolt length categories, and age of maturity classes. Artificial groupings by statistical week, gear type, and location by district, quadrant and area, used to estimate expansions and contributions to the fishery, add to the over-dispersion problem. The early and late "tails" of the migration suffered from this greatly. Detailed groupings by emigration date and smolt length often resulted in small *n* sizes for both the early and late groups of the migration, while strata used to compose the fishery expansion and contribution expanded each individual recovery to unrealistic levels. "Clumping" of tagged fish, i.e. occasionally traveling in schools can cause unrealistic expansions as well. All of these reasons cause problems for fine-scale stratification. In order to provide more reasonable measures of variance for the responses, bootstrapped standard errors were calculated. Although a different model could be suggested (i.e. negative binomial model) this would have eliminated the ability to model three response levels (adult survival, jack survival, and those that did not return).

RESULTS

Smolt migrations

The number of coho salmon smolt emigrating each year during the study, 1993-1997, was variable, but the emigration timing was relatively constant (Figure 2). The average number of smolts during the study was 6,111, range from 3,962 in 1996 to 8,103 in 1993 (Appendix 1). On average, the coho smolt migration started on May 7, ranging from May 4, 1994 to May 10, 1993, and finished by June 23. The midpoint of the migration ranged from May 16 (1994) to May 20 (1997) (Figure 2). During the five years, 94% of the smolts emigrated between May 10 and May 30; 33% between May 10 and 16, 42% between May 17 and 23, and 15% between May 24 and 30. Only 2.4% of the smolts migrated before May 10, and only 7% after May 31.

The relative emigration timing of smolts in each length category varied slightly but timing differed between length categories. Small and medium smolts had an average midpoint on May 22, and large and extra large smolts had an average midpoint on May 17. Large or medium smolts emigrated throughout the entire emigration, and small fish rarely emigrated early (Figure 3). All four groups peaked during the emigration period May 17-23 (Figure 3).

There was no relationship between emigration timing and return timing of jack and adult coho salmon. The potential timing relationship was examined by comparing the smolt emigration date to the commercial fishery landing date of harvested adult coho tagged at Auke Creek (Figure 4). Fishery landing dates in the areas where Auke Creek coho are harvested were used as a surrogate for the date of upstream migration; assuming that each fish harvested would have used the same amount of time to return from the fishery grounds to Auke Creek. This suggests equal mixing and susceptibility in the commercial fishery of adults from all smolt length categories, and justifies pooling data across years, regardless of emigration date, in analysis of emigration timing and smolt size effects. The duration of the emigration fluctuated slightly and did not show any dramatic differences between years or a pattern with respect to survival at Auke Creek.

Smolts from the four length categories comprised different percentages of the emigration. The small category comprised a small percentage of the smolts tagged during emigration, 3%, the medium category made up 27%, and large and extra large made up the largest proportions of the smolts tagged during migration, 39% and 31%, respectively (Figure 5).

Estimates of the jack, adult, and total survival resulting from five emigration periods and four length categories were significantly different (Figure 6, Appendix 2).

Covariance model of smolt length, date, and year effects on return length

The average lengths of jacks and adults varied between the five years (Table 1). The average length of jacks for the five-year study ranged from 305 mm in 1996 to 334 mm in 1993 (Table 1). The average length of adults for the five-year study was 623 mm and ranged from 609 mm in 1994 to 635 mm in 1993 (Table 1).

Return length of jacks

Smolt length, migration date and year were significant in determining length of returning jacks, ($P < 0.001$, Table 2). The interaction between smolt length and smolt year was not significant (P-value >0.45). Jacks produced from smolts leaving later in the migration were 1.4 mm shorter per day of release with all other variables fixed (Figure 7). Jacks resulting from extra large smolts were 17 mm longer than jacks from large smolts with all variables fixed (Table 2, Figure 8). All years had significantly shorter jacks compared to jacks that returned in 1993 (Table 2, Figure 9).

Return length of adults

Smolt length and migration date had significant inter-annual differences in the models of length of returning adults (Table 3). Because of significant (P-value < 0.001) two-way interactions between smolt year and smolt length, a separate model was estimated for each year. In all years, the length of returning adults from smolts that emigrated later were smaller, but migration date was significant only for the length of returning adults from the 1993 and 1997 smolt years (Figure 7). Adults produced from the 1993 and 1997 smolt years were an estimated 3.5 and 2.0 mm, respectively, smaller per day of release with all other variables fixed (Table 3). Smolt length was significant in all years and for all comparisons except for extra large smolts in 1994 (Figure 8). For 1994 smolts, adult lengths resulting from extra large smolts were not significantly different than adult lengths resulting from large smolts. In all other years, larger smolts returned as larger adults (Table 3), ranging 10.6 mm to 29.9 mm in length difference between consecutive length groups.

Multinomial model of date and length effects on adult and jack survival

A multinomial model was fit for each year to compare adult and jack survivals, because of significant (P-value < 0.0001) interactions between smolt length and year (Table 4). In all years, the odds of surviving as either a jack or an adult decreased for smolts leaving at later dates during the smolt migration (Table 4). Migration date was significant in all years for jack survival; the odds of surviving were 0.83 to 0.93 times less per increased day of emigration (Table 4). For adults, survival declined per increased day of emigration, but date was significant in 1997 only, when the odds of surviving 0.91 times less per increased day of emigration. Although date was significant only in 1997, the chances of the same trend occurring in all of the five years could not be attributed to a random event and indicates meaningful differences. On average, smolts leaving early in the migration had 0.91 times higher odds of returning as a jack rather than an adult, range 0.86 to 0.97. This was significant for all years (Table 4).

Large and extra large smolts had a greater chance of surviving and returning as a jack than not surviving at all. Smolt length was significant with respect to jack survival in 1993 and 1994 only (Table 4), and in all years jack survival increased with increasing smolt length. Although smolt length was significant only in 1993 and 1994, the chances of the same trend occurring in all of the five years could not be attributed to a random event and indicates meaningful differences. The odds of surviving and returning as a jack were roughly 2.5 to 3 times greater for large smolts than for medium smolts, and about 3 times greater for extra large smolts than for large smolts in 1993 and 1994 (Table 4).

In 1993, 1995, and 1997, smolts from the large and extra large length categories had significantly greater odds of surviving or returning as an adult than not returning (Table 4). The odds of surviving or returning as an adult were roughly 1.5 times greater for large smolts than for medium smolts in 1993, 1995, and 1997, and roughly 1.4 times greater for extra large smolts than for large smolts in 1993 and 1995 (Table 4). Adult survival of large smolts compared to medium smolts was significant in 1993, 1995, and 1997, and the trend occurred in four of the five years and could not be attributed to a random event. This indicates meaningful differences between survivals in relation to smolt lengths. Adult survival of extra large compared to large smolts was significant in 1993 and 1995, and the trend was consistent over three of the five years.

Setting the baseline category to survival of adults, the odds of surviving and returning as a jack, compared to an adult, was greater for larger smolts. The variable smolt length was significant in 1993 only. In 1993, smolts from the large category compared to smolts from the medium category had 2.3 to 3.3 times greater odds of surviving and returning as a jack than as an adult (Table 5), and 2.1 to 3.6 times greater odds of surviving and returning as a jack than as an adult for smolts from the extra large category compared to smolts from the large category had (Table 5). Although smolt length was statistically significant in one year, the trend is the same for all five years and is unlikely to be a random event.

Binomial model of date and length effects on total survival (GLM)

Interactions between smolt length and year were significant (P-value < 0.0001), therefore, for clarity and interpretation one model of total survival was estimated for each year. The odds of surviving ranged from 0.91 to 0.97 times less per day of release for smolts leaving later (Table 6), and emigration date was significant in all years except 1994 (Table 6), even though 1994 follows the same trend. Smolts from the large category compared to the medium category had significantly higher survival, in all years except 1994 and 1996 (Table 6), although 1996 followed the same trend as the three other years indicating a meaningful difference. In 1993, 1995, and 1997, smolts from the large category had 1.5 to nearly 2 times greater odds of surviving than smolts from the medium category (Table 6). Smolts from the extra large category compared to the large category had significantly higher odds of survival in 1993 and 1995, and approximately 1.6 times greater odds of survival than smolts from the large category (Table 6). Although statistically significant only in two years, all five years showed the same trend and would be an unlikely random event indicating a meaningful difference.

DISCUSSION

Two factors, time and size at smolt emigration, are important features of a coho salmon population that influence survival and subsequent contribution of genetic influence on future generations. Understanding these influences are important to harvest management, conservation, and health of stocks. Extended smolt emigrations allow some portion of the smolt migration to benefit from favorable conditions during the early marine experience. Smolt migration patterns at Auke Creek show that the most favorable conditions usually occur around mid-May, a time at which the majority of the smolts volitionally emigrate and from which a large portion of survival originates. Mortensen et al. (2000) provides evidence of such optimal time theory for pink salmon at Auke Creek. They found that seasonally changing low water temperature and prey limitations were important factors influencing growth. Although early emigrants experienced poor early growth conditions, survivors were observed to have grown to larger size at a given date than later emigrants, possibly protecting them from size-selective predation. In this study on coho salmon at Auke Creek estimates of predator abundance and food availability are lacking, although the consistent emigration patterns from year to year suggest that similar processes may influence coho salmon survival.

Although the influence of size and time on jacking or early maturation remains unclear, study of this supposedly adaptive strategy is important to fishery management, conservation biology, and population fitness. The principle benefit of shorter juvenile life history is increase probability of maturing. The numbers of successful spawners and genetic variability determines the viability of a population. Jacking increases the effective population size due to the interbreeding of brood years and the resulting increase in breeders for each return year. Van Doornik et al. (2002) found high jacking rates among wild fish, in a comparison of wild and hatchery coho salmon populations, indicating that jacks were viable and important to the genetic fitness and flow of genetic material in of wild populations. This demonstrates that brood years in a specific location genetically determine the production of a single population. Brood year failures can recover through naturally occurring gene flow between brood years. This genetic flow increases the chance of maintaining life history patterns in wild stocks, but ensures healthy effective population size and genetic fitness by increasing the number of viable spawners by another brood. In populations studied by Van Doornik et al. (2002) and in particular the hatchery population, the age structure exhibits 3-year old fish with very few 4-year old fish showing up in wild populations. At Auke Creek, the age composition consists of both 3 and 4 year old fish, and tends to favor older smolts (Taylor and Lum 2003). These life history patterns suggest a connection of two brood cycles as suggested by Van Doornik et al. (2002), but with complicated age structure. The importance of further study of this adaptive strategy, age composition, and genetic studies to evaluate lineage could provide detailed information on the connection between time- and size-dependent maturity.

Since 1977, marine survivals for Auke Creek coho salmon have averaged 24% with survivals being as high as 48%. The marine survivals observed at Auke Creek in comparison to other coho stocks and similar yearly changes of marine survival suggest that geographic location may have a role in determining relative survival. Auke Bay may provide a particularly productive area for food, and also a protected area for near shore rearing. Comparisons of marine survival, 1989-1997 smolt years, for three other wild Alaskan stocks showed Auke Lake, on average, tended to have the highest marine survival (24%, Shaul 1998). For Berner's River, Hugh Smith Lake, and Ford Arm Lake, estimated survival rates of coho salmon smolts and pre-smolts were 19%, 15%, and 12%, respectively; it was not possible to relate survival in those stocks to emigration timing or smolt length, but they have similar year-to-year changes of marine survival. All stocks experienced a decline in marine survival for the 1994 smolt year. Auke Lake and Ford Arm Lake experienced the lowest marine survivals between 1989-1997; and all stocks, except for Ford Arm Lake, experienced higher survivals for the 1993 smolt year.

Unlike findings at Hugh Smith Lake in 1985 (Shaul and Van Allen 2001), the study at Auke Creek showed length-dependent survival. Marine survival estimated for three size groups showed little difference in adult survival attributed to smolt length at Hugh Smith Lake, however jacks were not considered in estimating total survival. To compare the two studies data from the medium and large size groups of smolts at Auke Creek can be pooled; the result is that adult survival differences between length categories were more dramatic for Auke Lake smolts. Similar to Hugh Smith coho, smaller smolts had the lowest survival to adult (16% at Hugh Smith and 5% at Auke Creek). At Auke Creek the pooled groups (90 to 125 mm) had the second highest adult survival (22%) like Hugh Smith (20%). However at Auke Creek the largest smolts had the greatest survival (41%) while at Hugh Smith the largest smolts had no greater survival than the medium sized smolts (22%). From age composition information for Auke Creek (Taylor and Lum 2003), it could be suggested that the medium (100-120 mm) length category used at Hugh Smith Lake might mask overlapping sizes for two different age classes and differential survival based upon length or age. If emigration date been taken into consideration it could have possibly explained the differences in survival.

Smolts leaving early in the emigration produced larger jacks and adults than smolts that left later. Martin et al. (1981) found a similar pattern for hatchery reared pink salmon where mean length and weight of returning pink salmon declined with later date of release. However, pink salmon from the earlier release groups were smaller than their later cohorts because of the extended rearing period. This situation is reverse for coho smolts in the Auke Creek study. Instead of earlier emigrants being small, larger coho smolts emigrated early probably because they were older (Taylor and Lum 2003).

Early in the emigration, marine survival seemed to be enhanced by increasing smolt length; however, during the later portion of the migration, especially after June 1, poor survival occurred across all length categories. Smolt length and emigration date had different effects on survival depending on maturation age. For instance, larger smolts did not always produce jacks. Larger smolts originating early in the emigration could return either as a jack or an adult, but smolts from later in the emigration, and prior to June 1, usually returned as adults. The majority of the jack survival comes from the extra large smolts, but so does the greatest survival for adults. Although the adult survival for extra large smolts was relatively high across the emigration, it is not the case for jacks. The highest jack survival comes from the earliest portion of the emigration, and significantly declines with each successive emigration period.

Because of the lack of comparable information on wild Alaskan populations, hatchery studies outside Alaska were considered for making general rather than direct comparisons. Bilton et al. (1982) found an interaction between time and size at release with respect to survival from juvenile coho salmon raised at Rosewall Creek, B.C. Four release dates (April 14, May 12, June 10, and July 8, 1975) were selected, and before release a portion of the smolts were graded into three size groups based on the length distribution of the population at the time of release. After making this breakdown between lengths, Bilton et al. (1982) used weight at the time of release to make survival comparisons. The breakdown of the size groups relative to a changing length distribution resulted in different size ranges for each group on each release date, and caused overlapping in groups across release dates (Table 7) making a direct comparison impossible. In the Auke Creek project, length categories were the same over time, making the comparisons across release dates easier, and length rather than weight was used as the measure of size. Unlike Bilton et al. (1982), we found smaller smolts almost never survived if migrating early, and produced few adults or jacks. Bilton et al. (1982) reported a dramatic drop in returns after June 28 regardless of size. This was similar to what was found at Auke Creek although a month earlier, with the differences in date being attributed to the use of hatchery reared coho in Bilton et al.'s (1982) study.

Studies on size-dependent survival and overall annual variations of survival have shown differences between hatchery and wild populations. Larger sized hatchery smolts from early releases would be expected to produce greater numbers of jacks (Bilton et al. 1982, 1984). This is similar to the observations at Auke Creek. Johnson (1970) showed a distinct difference between two extreme size groups of coho salmon released from Big Creek Hatchery, Oregon. The larger size group (151 mm and 42 g) had higher smolt-to-adult, 50%, and smolt-to-jack survival, 7%, than the smaller size group (114 mm and 17 g). Although there are only two size groups and no reference to time, these findings on size-dependent survival are similar to Biltons (1982) results, and are similar to the observations at Auke Creek. Unlike these studies, Holtby et al. (1990) observed that greater smolt size over a 17-year period at Carnation Creek, B.C., did not provide a consistent survival advantage except in years in which overall marine survival was relatively low. Of the five years of the study at Auke Creek, the 1994 smolt year (one of average smolt size) had the lowest marine survival and 1996 (average smolt size) the next lowest (Appendix 6). Over all years large size produced significant differences in survival, giving 1.5 to 2-fold advantage (Table 6), the effect was not significant in 1994 or 1996 smolt years. Contrary to Holtby et al. (1990), size did not provide an advantage in an overall low survival year. Instead, the Auke Creek findings suggest that in years of lower survivals the effects are felt throughout the entire population and throughout the emigrant period regardless of size.

At Auke Creek, coho jacks resulted from the extra large and large smolts that emigrated early. It is not known why jacks occur frequently in some coho stocks and not in others, whether age of maturity is perpetuated in the population by inheritance, or whether jacks have an overall importance to the health of the stock. In general, jacking is highly variable across escapement populations between years and between systems (Sandercock 1991), but because of the difficulty of observing jacks, most coho assessments provide little information on them. The Auke Creek results appear on the surface to support Thorpe et al.'s (1986,1989) energetic model describing the process of maturation for Atlantic salmon (*Salmo salar*), suggesting that jacks are produced because of their nutrient and energetic history. This is supported by Hager and Noble (1976) who found that larger smolts tended to mature as jacks in releases of hatchery reared coho salmon at Minter Creek Salmon Hatchery, WA., stressing the influence of the faster growth rate of larger smolts as the prime factor in early maturity. It could be suggested that the larger smolts leaving Auke Creek resulted from higher growth rates, and by Thorpe's theory resulted in smolting and maturing in the same year. However, unlike the hatchery reared Atlantic salmon that Thorpe et al.'s (1986, 1989) work is based on, and the hatchery reared coho released at Minter Creek (Hager and Noble 1976), the larger smolts that do return as jacks to Auke Creek are from smolts that have spent 2 years in freshwater before their seaward migration (Jerry Taylor, NMFS, Auke Bay Laboratory, personal communication). These larger, older smolts therefore took longer to reach the threshold conditions for smoltification, which suggests a slower growth rate linked with early maturation. Although the energetic theory is made more complicated by the age composition of the Auke Creek population, the theory that this life history strategy is inherited (Gross 1984, 1985) is also not clearly supported. The strong correlation of smolt length to jack survival indicates something more than direct inheritance.

Although the effects of ecological factors in relation to marine survival are not yet understood, this study provides a unique suite of baseline information to build upon for further studies and analysis for a specific population of wild Alaskan coho salmon. Although age class could not be directly related back to individual tagged smolts in this study, inclusion of age as a factor or an estimation of the portion of age classes comprising the groups already defined by time and size could be evaluated for possible effects on marine survival. Age and growth information can be estimated from the scale analysis of jacks and adults that survived to determine other clues to marine survival. The inclusion of coho salmon stocks in the local area and along the SE Alaskan coast could be added to determine whether similar patterns exist for other stocks or whether patterns seen are unique to Auke Lake.

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TABLES

Table 1.-Average return length (mm) of adult and jack coho salmon from Auke Creek by year.

	Year	Average (mm)	SE (mm)	Range (mm)	n
Adults	1993	635	2.3	(425, 732)	444
	1994	609	3.7	(450, 710)	129
	1995	611	2.8	(430, 706)	286
	1996	627	3.4	(476, 735)	169
	1997	620	3.3	(419, 710)	199
	All Years	623	1.4	(419, 735)	1227
Jacks	1993	334	1.4	(260, 390)	268
	1994	311	2.6	(260, 370)	83
	1995	314	2.9	(245, 395)	96
	1996	305	3.2	(255, 370)	66
	1997	325	2.2	(260, 380)	96
	All Years	323	1.1	(245, 395)	609

Table 2.-Summary statistics for the ANCOVA model of jack return length. Variable smolt length category D was compared to variable smolt length category C, where C = large and D = extra large. All years were compared to the arbitrary baseline year of 1993.

Variable	Estimated Coefficient	SE	*p*-value
Intercept	515.0	41.57	< 0.001
Date (mm/day)	-1.4	0.30	< 0.001
Smolt length D	17.1	1.95	< 0.001
1994	-28.6	2.83	< 0.001
1995	-21.4	3.13	< 0.001
1996	-30.1	3.06	< 0.001
1997	-12.1	2.38	< 0.001

$R^2 = 0.31$, $\hat{\sigma}^2 = 469.2$, d.f. = 598

Table 3.-Summary statistics for the ANCOVA models of adult return length by year. Variable smolt length category C was compared to variable smolt length category B, and variable smolt length category D was compared to variable smolt length category C, where B = medium, C = large, and D = extra large.

Year	Variable	Estimated Coefficient	SE	*p*-value
1993	Intercept	1125.4	70.07	< 0.001
	Smolt length C	11.5	3.94	0.004
	Smolt length D	10.6	2.85	< 0.001
	Date (mm/day)	-3.5	0.51	< 0.001
$R^2 = 0.24$, $\hat{\sigma}^2 = 389.67$, d.f. = 264				
1994	Intercept	788.8	94.50	< 0.001
	Smolt length C	15.6	5.43	0.005
	Smolt length D	8.0	5.20	0.13
	Date (mm/day)	-1.3	0.69	0.06
$R^2 = 0.12$, $\hat{\sigma}^2 = 1608.8$, d.f. = 124				
1995	Intercept	755.7	85.47	< 0.001
	Smolt length C	15.9	7.89	0.05
	Smolt length D	16.1	4.87	0.001
	Date (mm/day)	-1.1	0.62	0.08
$R^2 = 0.06$, $\hat{\sigma}^2 = 2209.9$, d.f. = 274				
1996	Intercept	677.3	97.92	< 0.001
	Smolt length C	29.9	5.69	< 0.001
	Smolt length D	24.4	4.66	< 0.001
	Date (mm/day)	-0.4	0.70	0.59
$R^2 = 0.24$, $\hat{\sigma}^2 = 1444.8$, d.f. = 156				
1997	Intercept	888.8	118.54	< 0.001
	Smolt length C	20.1	6.55	0.003
	Smolt length D	12.9	4.96	0.01
	Date (mm/day)	-2.0	0.84	0.02
$R^2 = 0.14$, $\hat{\sigma}^2 = 1907.9$, d.f. = 192				

Table 4.-Summary statistics for the multinomial models of survival (jacks and adults) by year. Adult and jack survival compared to the baseline category of numbers of coho salmon that did not return. Variable smolt length category C was compared to smolt length category B, and variable smolt length category D was compared to smolt length category C; where B = medium, C = large, and D = extra large. $\hat{\phi}$ is the estimated dispersion parameter for the model.

Model	Variable	Year	Estimated Coefficient	SE	*p*-value	Odds	95% CI
Adults	Intercept	1993	1.85	2.35	0.43	-	-
	Smolt length C		0.31	0.16	0.06	1.37	1.00-1.87
	Smolt length D		0.33	0.12	0.01	1.39	1.11-1.74
	Date		-0.02	0.02	0.32	0.98	0.95-1.02
Jacks	Intercept		21.27	3.77	< 0.001	-	-
	Smolt length C		1.14	0.33	< 0.001	3.13	1.65-5.91
	Smolt length D		1.05	0.19	< 0.001	2.84	1.98-4.09
	Date		-0.17	0.03	< 0.001	0.85	0.80-0.89
d.f. = 120, $\hat{\phi}$ = 5.996							
Adults	Intercept	1994	-0.32	4.35	0.94	-	-
	Smolt length C		-0.28	0.20	0.17	0.76	0.51-1.13
	Smolt length D		-0.12	0.20	0.53	0.89	0.60-1.30
	Date		-0.01	0.03	0.73	0.99	0.93-1.05
Jacks	Intercept		16.48	4.43	< 0.001	-	-
	Smolt length C		0.93	0.48	0.06	2.53	1.73-3.70
	Smolt length D		1.16	0.27	< 0.001	3.20	2.53-4.04
	Date		-0.15	0.03	< 0.001	0.86	0.81-0.92
d.f. = 102, $\hat{\phi}$ = 8.123							
Adults	Intercept	1995	4.79	2.86	0.10	-	-
	Smolt length C		0.51	0.14	< 0.001	1.66	1.27-2.18
	Smolt length D		0.30	0.15	0.05	1.35	1.01-1.80
	Date		-0.04	0.02	0.45	0.96	0.92-1.00
Jacks	Intercept		6.97	4.18	0.10	-	-
	Smolt length C		1.96	2.71	0.47	7.08	0.04-1422.80
	Smolt length D		1.52	1.36	0.27	4.55	0.31-65.90
	Date		-0.07	0.03	0.01	0.93	0.88-0.98
d.f. = 100, $\hat{\phi}$ = 4.874							
Adults	Intercept	1996	4.66	3.10	0.14	-	-
	Smolt length C		0.12	0.14	0.36	1.13	0.87-1.48
	Smolt length D		-0.10	0.17	0.56	0.91	0.66-1.26
	Date		-0.04	0.02	0.06	0.96	0.92-1.00
Jacks	Intercept		16.62	5.54	0.004	-	-
	Smolt length C		1.07	2.60	0.68	2.91	0.02-474.62
	Smolt length D		0.84	1.34	0.53	2.32	0.17-32.11
	Date		-0.14	0.04	< 0.001	0.87	0.81-0.94
d.f. = 106, $\hat{\phi}$ = 4.086							

Table 4 (cont.).-Summary statistics for the multinomial models of survival (jacks and adults) by year. Adult and jack survival compared to the baseline category of numbers of coho salmon that did not return. Variable smolt length category C was compared to smolt length category B, and variable smolt length category D was compared to smolt length category C; where B = medium, C = large, and D = extra large. $\hat{\phi}$ is the estimated dispersion parameter for the model.

Model	Variable	Year	Estimated Coefficient	SE	*p*-value	Odds	95% CI
Adults	Intercept	1997	11.85	5.04	0.02	-	-
	Smolt length C		0.50	0.19	0.01	1.65	1.13-2.40
	Smolt length D		-0.03	0.23	0.90	0.97	0.62-1.52
	Date		-0.09	0.04	0.01	0.91	0.85-0.98
Jacks	Intercept		23.07	5.54	< 0.001	-	-
	Smolt length C		2.11	2.74	0.45	8.23	0.04-1817.50
	Smolt length D		1.68	1.38	0.23	5.35	0.35-81.14
	Date		-0.19	0.04	< 0.001	0.83	0.77-0.89

d.f. = 90, $\hat{\phi}$ = 8.279

Table 5.-Summary statistics for the multinomial models of survival by year, with baseline category equal to adult returns. Survival of jacks was compared to the baseline category of numbers of coho salmon that returned as an adult. Variable smolt length category C was compared to smolt length category B, and variable smolt length category D was compared to smolt length category C, where B = medium, C = large, and D = extra large. $\hat{\phi}$ is the estimated dispersion parameter for the model.

Model	**Variable**	**Year**	**Estimated Coefficient**	**SE**	***p*-value**	**Odds**	**95% CI**
Jacks vs. Adults	Intercept	1993	19.19	3.5	< 0.001	-	-
	Smolt length C		0.85	0.28	0.004	3.02	1.35-4.03
	Smolt length D		0.72	0.17	< 0.001	4.26	1.48-2.88
	Date		-0.15	0.03	< 0.001	0.86	0.82-0.91
d.f. = 120, $\hat{\phi}$ = 5.996							
Jacks vs. Adults	Intercept	1994	16.80	5.21	0.002	-	-
	Smolt length C		1.21	1.50	0.425	3.34	0.17-64.0
	Smolt length D		1.29	0.76	0.099	3.61	0.80-16.3
	Date		-0.14	0.04	< 0.001	0.87	0.81-0.94
d.f. = 102, $\hat{\phi}$ = 8.123							
Jacks vs. Adults	Intercept	1995	2.19	5.09	0.669	-	-
	Smolt length C		1.45	4.54	0.751	4.25	0.001-30801
	Smolt length D		1.22	2.27	0.593	3.39	0.04-287.6
	Date		-0.03	0.03	0.335	0.97	0.91-1.03
d.f. = 100, $\hat{\phi}$ = 4.874							
Jacks vs. Adults	Intercept	1996	11.95	5.47	0.033	-	-
	Smolt length C		0.94	2.37	0.693	2.57	0.03-268.81
	Smolt length D		0.94	1.20	0.439	2.55	0.24-26.93
	Date		-0.10	0.04	0.010	0.91	0.84-0.97
d.f. = 106, $\hat{\phi}$ = 4.086							
Jacks vs. Adults	Intercept	1997	11.23	5.44	0.045	-	-
	Smolt length C		1.61	2.75	0.561	4.99	0.02-1112.2
	Smolt length D		1.70	1.39	0.228	5.49	0.35-85.12
	Date		-0.098	0.04	0.011	0.91	0.84-0.975
d.f. = 90, $\hat{\phi}$ = 8.279							

Table 6.-Summary statistics for the binomial models of total survival by year. Variable smolt length category C was compared to variable smolt length category B, and variable smolt length category D was compared to variable smolt length category C, where B = medium, C = large, and D = extra large. $\hat{\phi}$ is the estimated dispersion parameter for the model.

Year	Variable	Estimated Coefficient	SE	*p*-value	Odds	95% CI
1993	Intercept	5.76	2.24	0.01	-	-
	Smolt length C	0.43	0.16	0.01	1.54	1.13-2.11
	Smolt length D	0.48	0.10	< 0.001	1.61	1.31-1.96
	Date	-0.04	0.02	0.01	0.96	0.93-0.99
d.f. = 60, $\hat{\phi}$ = 8.126						
1994	Intercept	2.46	4.07	0.55	-	-
	Smolt length C	-0.11	0.20	0.58	0.90	0.61-1.32
	Smolt length D	0.15	0.18	0.42	1.16	0.004 - 1.65
	Date	-0.03	0.03	0.32	0.97	0.92-1.03
d.f. = 52, $\hat{\phi}$ = 13.836						
1995	Intercept	5.08	2.19	0.02	-	-
	Smolt length C	0.57	0.13	< 0.001	1.78	1.39-2.27
	Smolt length D	0.44	0.13	0.001	1.56	1.21-2.01
	Date	-0.04	0.02	0.01	0.96	0.93-0.99
d.f. = 60, $\hat{\phi}$ = 6.307						
1996	Intercept	4.62	2.51	0.07	-	-
	Smolt length C	0.22	0.12	0.07	1.25	0.99-1.58
	Smolt length D	0.08	0.14	0.59	1.08	0.82-1.43
	Date	-0.04	0.02	0.03	0.96	0.93-0.99
d.f. = 59, $\hat{\phi}$ = 5.958						
1997	Intercept	12.67	4.47	0.01	-	-
	Smolt length C	0.65	0.18	< 0.001	1.92	1.36-2.71
	Smolt length D	0.24	0.20	0.23	1.27	0.86-1.86
	Date	-0.10	0.03	0.004	0.91	0.83-0.97
d.f. = 52, $\hat{\phi}$ = 13.221						

Table 7.-Average juvenile weight (g) at release for each size group used in Bilton et al. 1982. Release dates (Julian days) refer to the number of days elapsed from January 1, 1975.

Release date, 1975	Size group	Pond Populations						Max	Min
		Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6		
14-Apr	S	5.1	9	9.2	7	9.6	10.6	10.6	5.1
(day 104)	M	8.1	11.6	12.9	9.6	12.6	14.2	14.2	8.1
	L	10.9	15.4	16.1	13.3	16.7	18.8	18.8	10.9
12-May	S	8.3	12.5	11.7	7.7	13.8	14	14	7.7
(Day 132)	M	11.9	15.7	15.1	11	18.1	18.5	18.5	11
	L	15.1	20.8	19.2	15.3	23.9	25.8	25.8	15.1
10-Jun	S	12.3	15.6	14.4	12.3	17.3	17.6	17.6	12.3
(Day 161)	M	16	20.1	18.9	16.3	22.1	23.6	23.6	16
	L	20.2	28.3	25.1	19.9	28.7	31.8	31.8	19.9
8-Jul	S	14.9						14.9	14.9
(Day 189)	M	24.8						24.8	24.8
	L	33.1						33.1	33.1

FIGURES

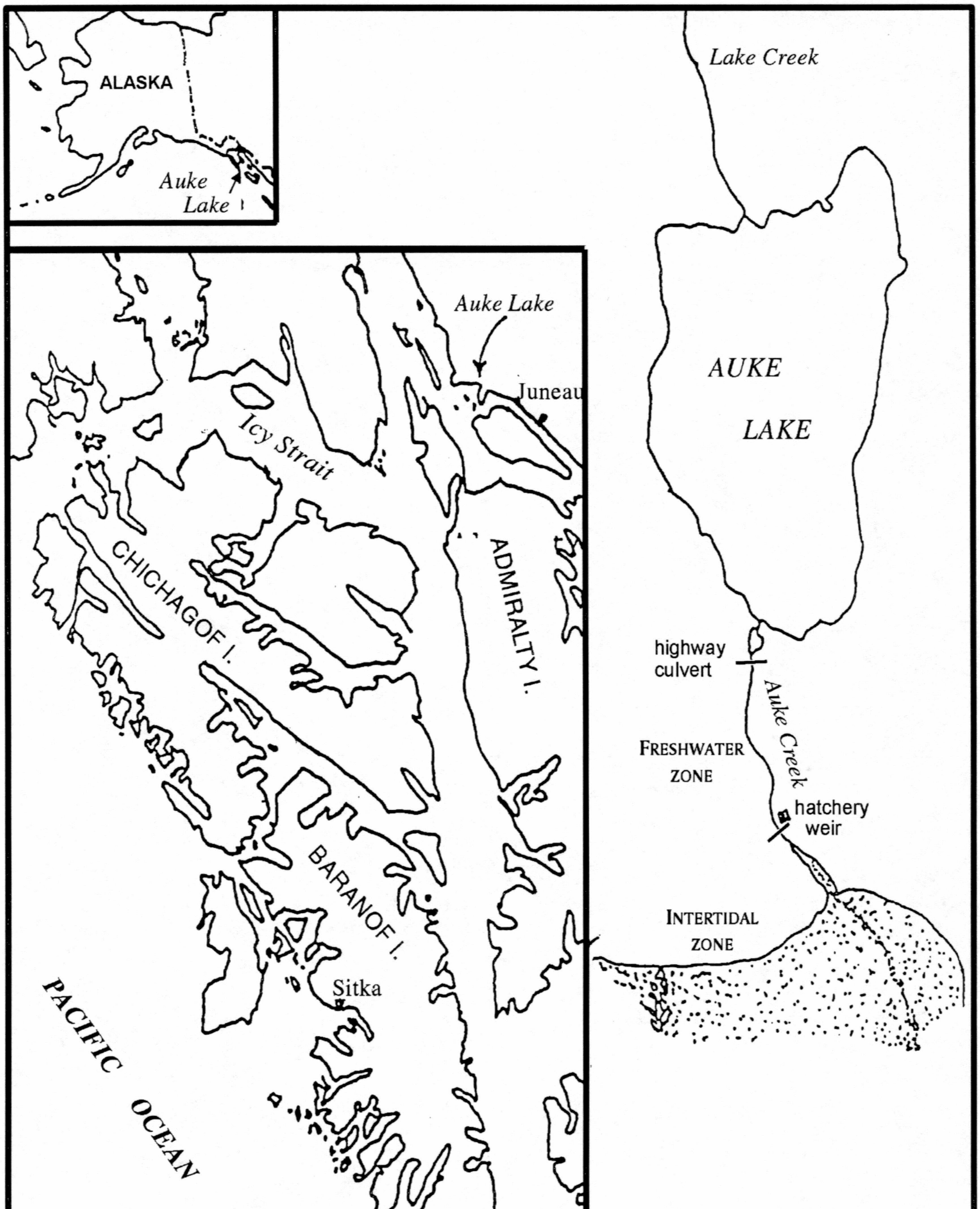

Figure 1.-Northern southeast Alaska and the Auke Lake system.

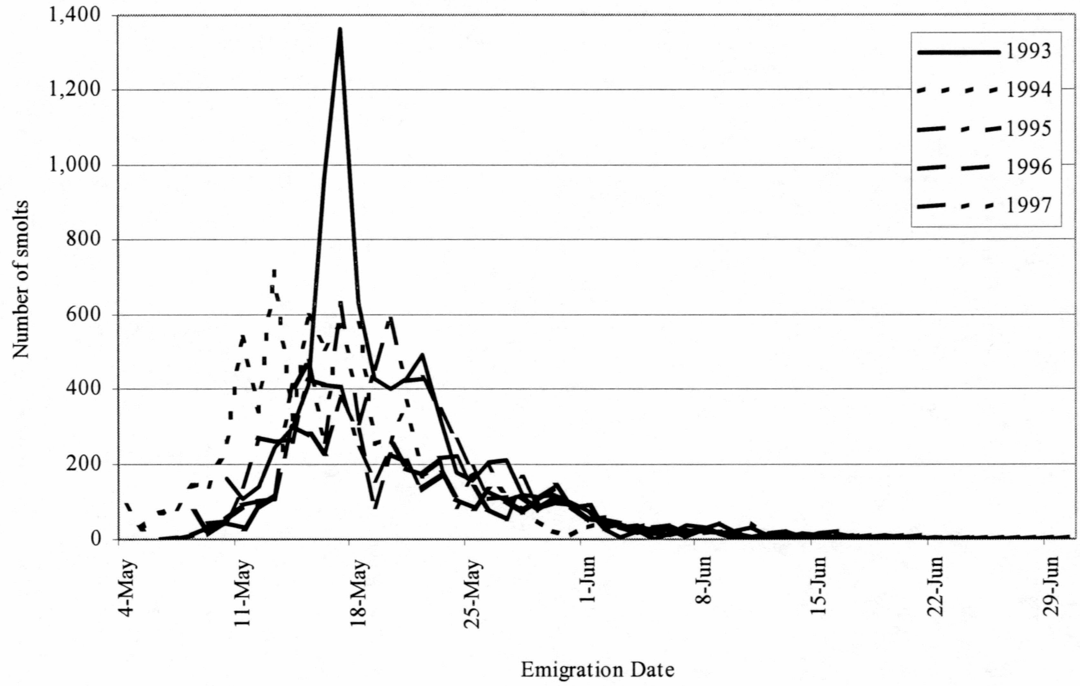

Figure 2.- Numbers of coho salmon smolts emigrating each day, at Auke Creek, during 1993-1997.

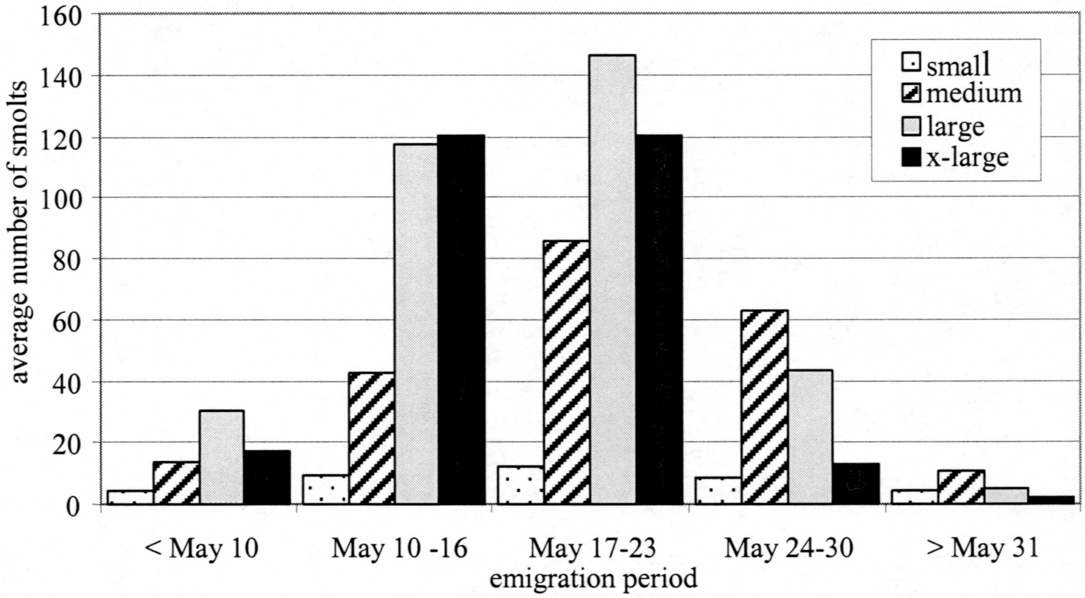

Figure 3.-Average number of coho smolts emigrating at Auke Creek, 1993-1997, by day within emigration periods and smolt length category.

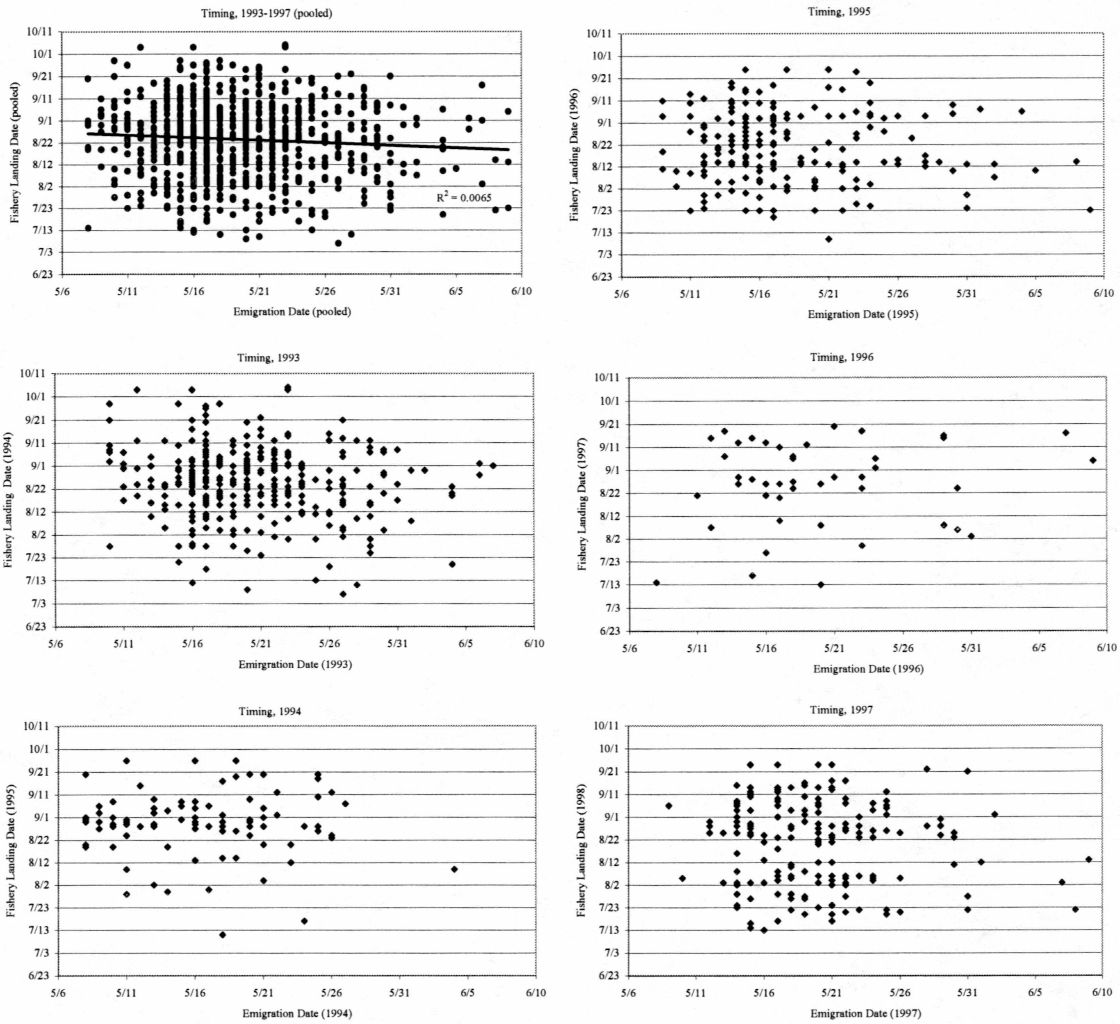

Figure 4.-Emigration date compared to date of fishery landing for each smolt year. Timing is in relation to smolt year and fishery landing dates are for areas where Auke Creek coho are harvested in the fishery.

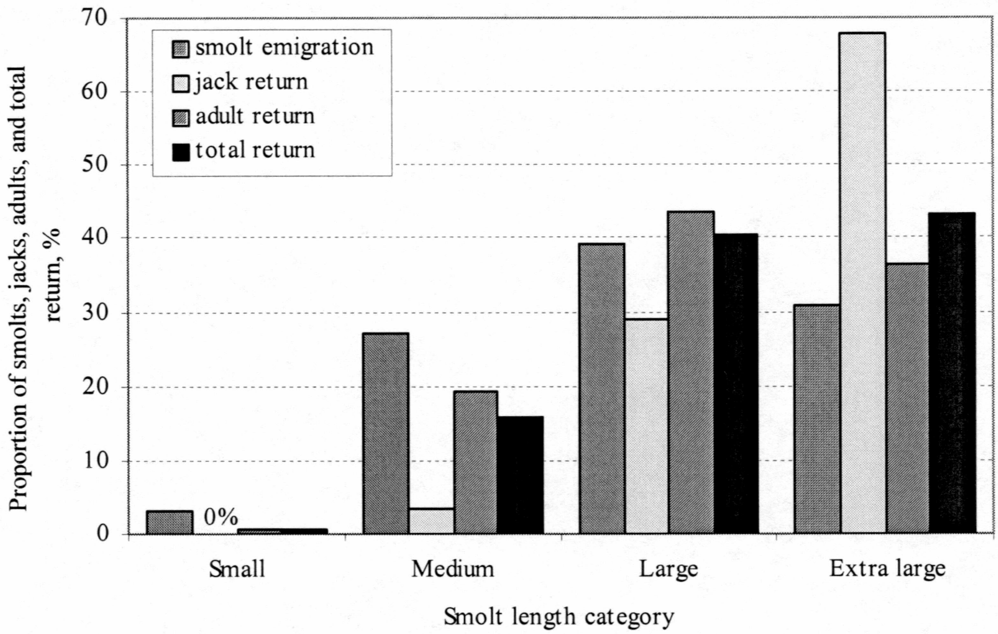

Figure 5.-Run composition of emigrant smolts, returning jacks and adults, and the total return (jacks plus adults) of coho salmon, 1993-1997 smolt years combined. The number above the x-axis is the percent of coho jacks that returned in the small smolt category.

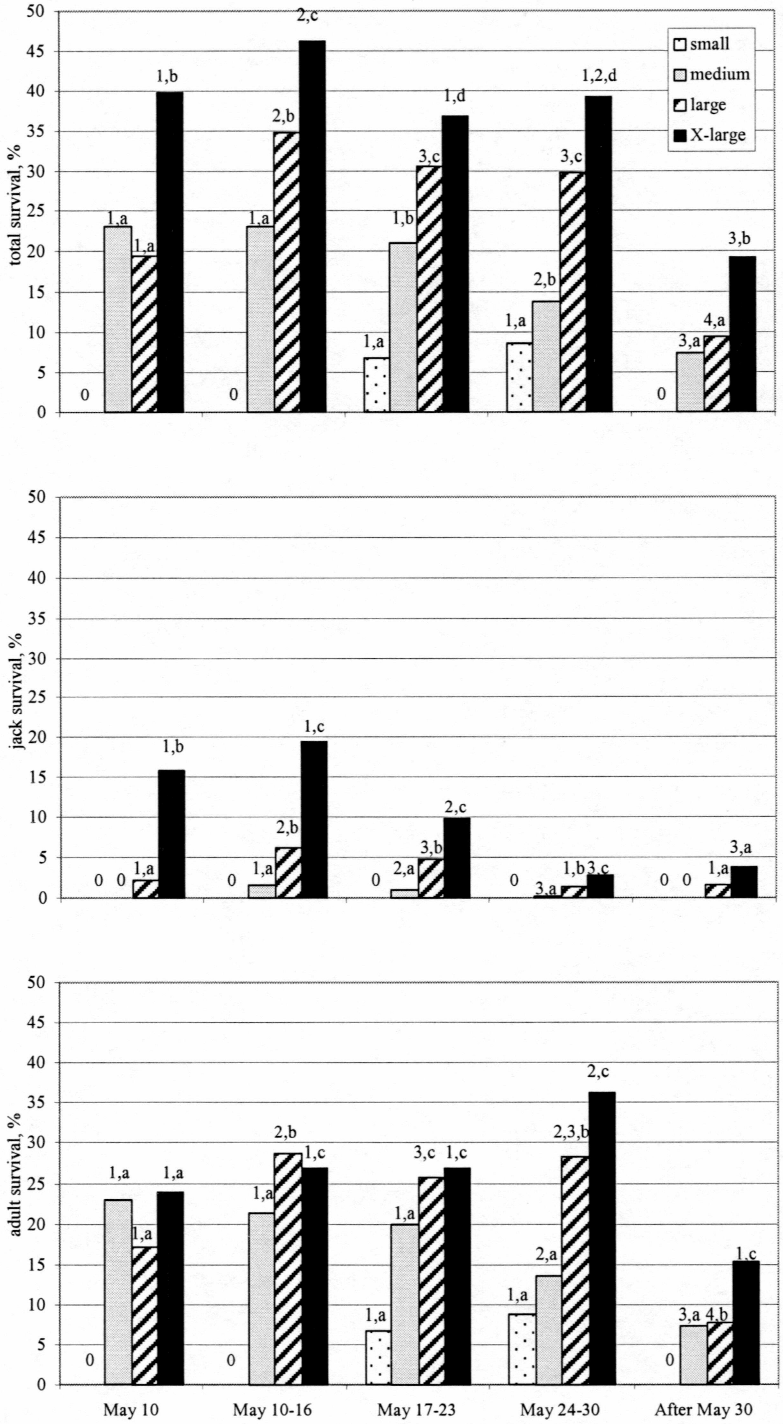

Figure 6._Survival of coho salmon in four length categories from five emigration periods at Auke Creek, 1993-1997 combined. The "0" above the x-axis indicates no survival in those smolt categories. Numbers of fish in each length category tested across emigration period and in each migration period tested across length category are significantly different (P $\leq$ 0.05) if indicated by a number or a letter, respectively, above each bar.

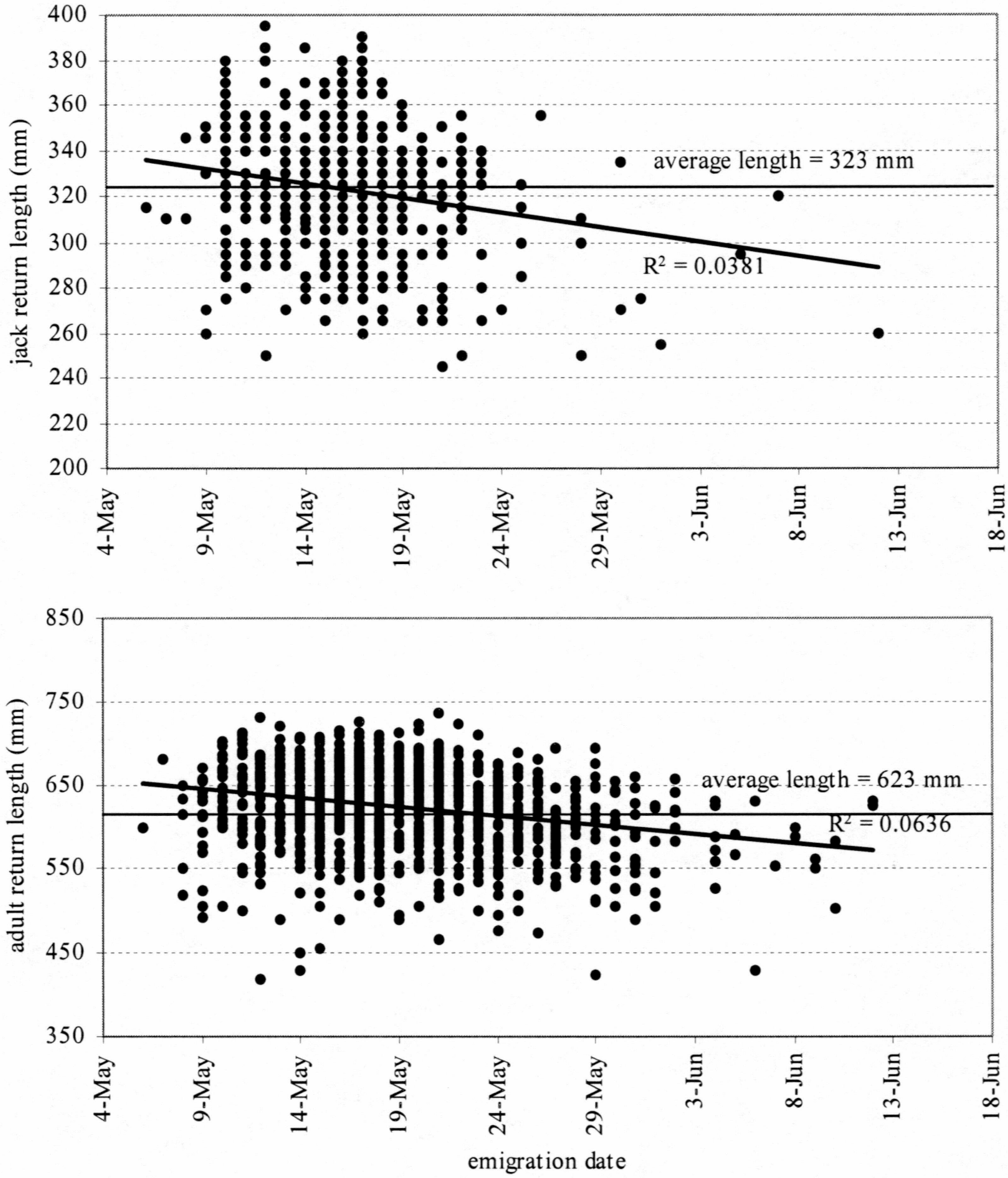

Figure 7.-Sampled lengths (mm) for returning jacks and adults to Auke Creek, 1993-1997.

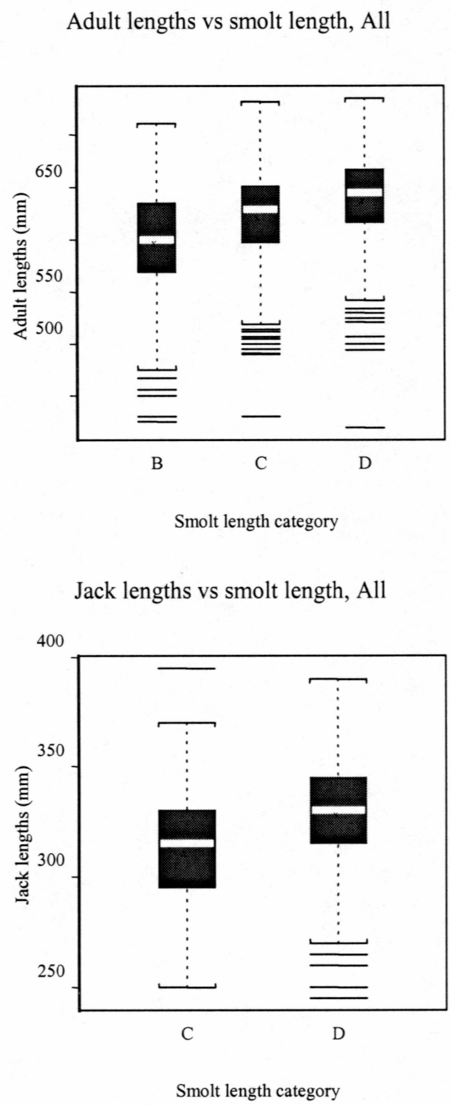

Figure 8.- Returning lengths (mm) of adults and jacks by smolt length categories. The bars represent the location and spread of sampled lengths of adults and jacks. The white line intersecting the bars represents the median and the "x" representing the sample mean. Comparisons were completed for length categories with sufficient returns to test. Smolt length category B = medium, C = large, and D = extra large.

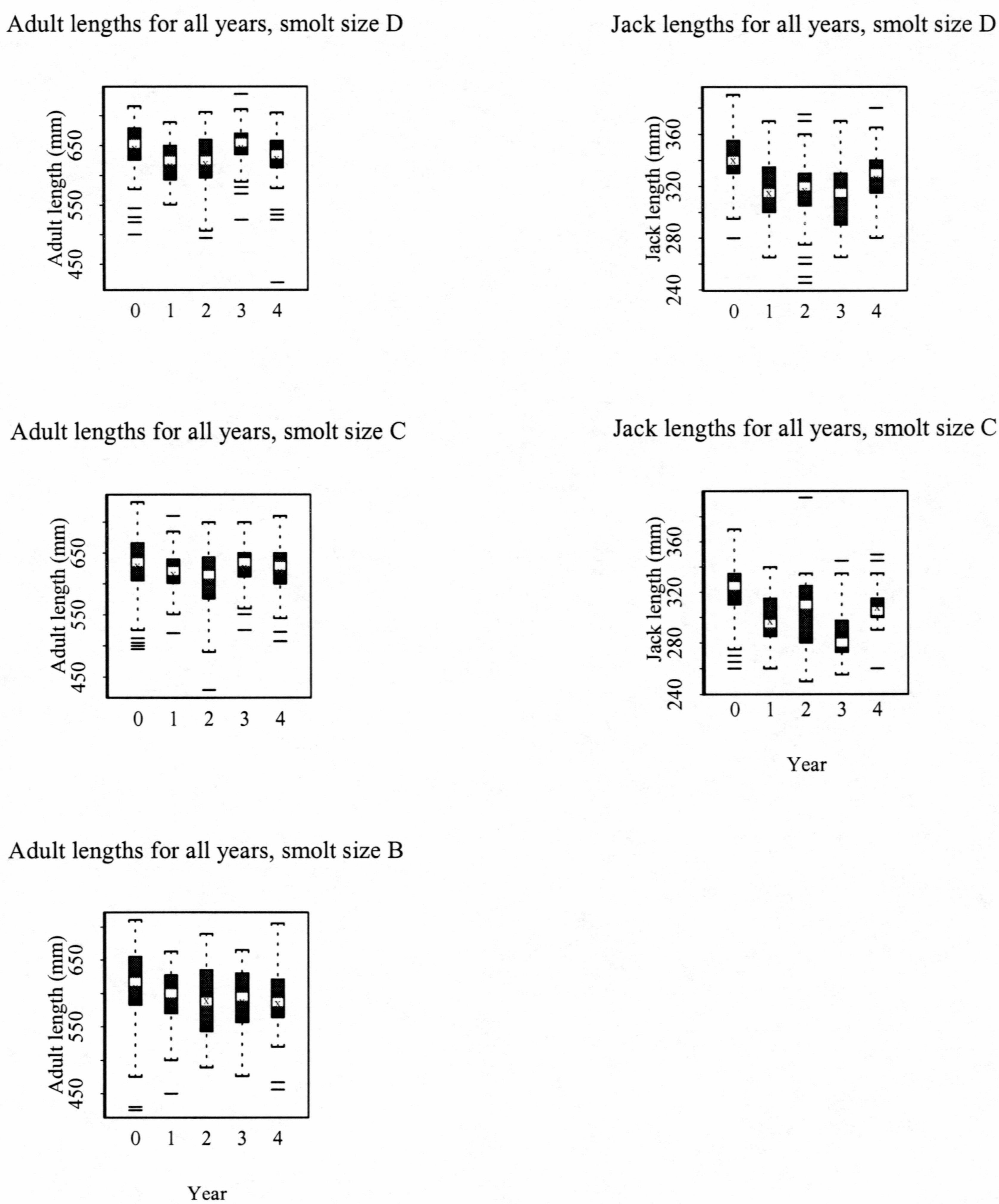

Figure 9.- Returning lengths (mm) for adults and jacks by smolt year separated by smolt length category. Smolt year 0 = 1993, smolt year 1 = 1994, smolt year 2 = 1995, smolt year 3 = 1996, and smolt year 4 = 1997. Smolt length category B = medium, C = large, and D = extra large.

APPENDICES

Appendix 1.-Coho smolt migrations for Auke Creek, 1993–1997.

Smolt Year	Total Smolts	Total Tagged	Migration Dates Start	End	Midpt.	% leaving before June 1	Total in May	Total in June
1993	8,103	7,844	10-May	15-Jun	18-May	96	7,580	264
1994	7,416	7,255	4-May	21-Jun	16-May	96	6,956	299
1995	4,869	4,798	9-May	29-Jun	18-May	92	4,394	404
1996	3,962	3,919	8-May	24-Jun	19-May	91	3,560	359
1997	6,207	6,080	6-May	29-Jun	20-May	94	5,689	391
Avg.	6,111	5,979	7-May	23-Jun	18-May	94	5,636	343

Appendix 2.-Number of smolts tagged and percent survival of jack and adult coho salmon for four length categories and five migration periods. The percent survival to jacks and adults are the proportion of adults and jacks for the smolts leaving in a particular length category and migration period. The data in this table is from smolts years 1993-1997, combined, and corresponds to the numbers recorded in Table 1.

Length Category	Migration Periods Numbers of smolts < May 10	May 10-16	May 17-23	May 24-30	>May 30	Total
Small	37	190	337	229	94	887
Medium	134	1480	3008	2185	1269	8076
Large	314	4123	5133	1476	649	11695
X-Large	247	4210	4224	479	78	9238
Total	732	10003	12702	4369	2090	29896
Percent survival to jacks for each size-time strata						
Small	0	0	0	0	0	0
Medium	0	1.69	1.00	0.27	0.00	0.76
Large	2.23	6.23	4.95	1.36	1.69	4.69
X-Large	15.79	19.36	9.87	2.92	3.85	13.94
Total	6.28	10.97	5.52	0.92	0.67	6.35
Percent survival to adults for each size-time strata						
Small	0	0	6.82	8.73	0	4.85
Medium	23.13	21.35	19.91	13.50	7.41	16.53
Large	17.20	28.57	25.58	28.32	7.70	25.76
X-Large	23.89	26.86	26.80	36.33	15.38	27.15
Total	19.67	26.24	24.15	20.76	7.46	23.08
Percent survival, jacks plus adults, for each size-time strata						
Small	0	0	6.82	8.73	0	4.85
Medium	23.13	23.04	20.91	13.78	7.41	17.29
Large	19.43	34.80	30.53	29.67	9.40	30.46
X-Large	39.68	46.22	36.67	39.25	19.23	41.09
Total	25.96	37.21	29.66	21.68	8.13	29.43

Appendix 3. -Sequential coded-wire tags for the identification of small groups of individual specimens and a description on deciphering binary code (Northwest Marine Technology, Inc.).

Sequential Coded Wire Tags for Identification of Small Groups and Individual Specimens (U.S. Patent #4,955,396)

The **Binary Coded Wire Tagging** system is the most widely used method of marking fish for scientific purposes. The *Standard* Binary Coded Wire Tag is designed to identify "batches" of fish, and is impractical for identifying small groups and individual specimens. The development of *Sequential* Coded Wire Tags addresses this need.

Coded Wire Tag Format

A Coded Wire Tag (CWT) consists of stainless steel wire, which is 0.25 mm in diameter cut into increments ranging from *0.5* mm to 2.0 mm long. The injector cuts the tag from a spool of wire, magnetizes and implants it into the specimen through a hollow needle. Specialized magnetic detectors are used to detect and recover the tags. To be read, the tags must be removed from the specimen and examined under magnification.

The tags bear a binary code in the form of rows of marks along the long axis. These marks translate into numbers based upon their location within the code. The result is a series of code numbers, which contain the data for the fish and the tagging agency. (See example in Figure 2).

	P	32	16	8	4	2		1	
Master	0	0	1	1	1	1	1	1	
Data 1	0	1	0	0	1	0		1	= 37
Agency		Not visible in diagram							
Data 2	1	0	1	1	0	0		0	= 24

Figure 2. Diagram of the Standard CWT and the binary coding system. Proper orientation and rotational direction is indicated. In the table, a "1" indicates the presence of a mark and a "0" indicates the absence of a mark. The master row serves as the basis for tag orientation and can be recognized by the three crowded marks. Recognition of the master row is important because tags are rarely cut with an uninterrupted code (as shown here). More often, part of the code will be on either end of the tag. The "P" (parity) column serves as a check for code recognition and a mark in this column adds no numeric value to the code number. There must always be an odd number of marks counted in one row. If the numeric code is represented by an even number of marks, a mark will be present in the "P" column to ensure proper counting. In the example above, the "Data 1" row has marks in the 1,4, and 32 columns, an odd number so no mark is needed in the "P" column. The "Data 2" row has marks in the 8 and 16 columns, an even number which makes the mark in the "P" column necessary.

Standard CWTs are typically used to identify groups or batches of fish, numbering in the thousands, with the same code. Standard CWTs have four code rows:

the Master, Data 1 (D1), the Agency and Data 2 (D2). The code rows are identified by their consistent relationship to the Master. The Master is the same on all standard tags and can be immediately identified by its uniform series of six marks which includes a uniquely crowded series of three - the middle of which lies between the 1 and 2 columns, allowing proper orientation of the tag. Once this is done, the other rows are in order as the tag is rolled over. Rows Dl and D2 bear the codes providing the information on the specimen.

Sequential CWTs differ from Standard CWTs by having six binary code rows: a Master, Dl, D2, the Agency, Data 3 (D3), and Data 4 (D4). Dl, D2, and the Agency convey the same information as in the standard CWT and are read the same. The Master for Sequential CWT serves the same function as the Master for the Standard CWT, but the code is unique to help differentiate the Sequential CWTs from other types of NMF Coded Wire Tags. D3 and D4 are the rows, which convey special sequence codes, and the technique for reading them is different from the Standard CWT. As explained in the next section, once code numbers are determined for D3 and D4, the actual sequence number can be derived from the table or with the aid of computer software supplied by NMT. The information from the two seven-bit data fields of D3 and D4 can represent 10,000 sequence numbers and, for each agency code, there are 3,969 such sequences, which can be distinguished by available combinations of Dl and D2.

Reading Sequential CWTs

The format of Sequential CWTs (Figure 3) was designed with two things in mind: 1) the tag injectors cut tags of uniform length but without regard to alignment of the code pattern, and 2) to ensure that cut tags contain a complete code, they are about 20'/o longer than one code pattern. As a result, more often than not the cut tag will bear part of one code pattern on one end, and part of the next pattern on the other end. The patterns are designed so that successive patterns differ by exactly one binary mark position. For this reason a table must be used after reading the tag to determine the actual sequence number. (The table is available as a DOS format computer program or in tabular form from NMT.) Also, there is a possibility that the D3 or D4 positions at the opposite ends of the tag could be marked differently. The coding format insures that either choice can be made and the two choices will always correspond to two consecutive sequence numbers. Because the tags are cut longer than the code pattern, some of the tag codes will inevitably be lost. When tagging individuals, a code may or may not be lost, so the starting and ending sequence numbers may differ by either 2 or 3 depending on how the injector happens to cut the wire.

	P	32	16	8	4	2		1	
Master	0	1	1	1	1	1	1	1	
Data 1	1	0	1	0	1	1		1	= 23
Data 2	0	1	1	0	0	0		1	= 49
Agency	0	1	1	0	0	1		0	= 50
Data 3	1	1	0	0	0	0		1	= 97
Data 4	1	0	1	0	1	0		1	= 85

Agency not visible in diagram.

Figure 3. Diagram of a Sequential CWT and the binary coding system. The master row is recognized by the same three crowded marks as the standard CWT, but a mark in the 32 column of the master row identifies it as a sequentially coded tag. The "P" column serves the same purpose as in standard CWT for the Dl, D2, and agency rows, but must be counted differently for D3 and D4. In the D3 and D4 rows, the "P" column represents a numeric value of 64 and the number of marks per row is not always odd.

Once the D3 and D4 code numbers are determined, the table (a page from which is attached) must be consulted to determine the sequence number. The table has columns labeled with Data 3 values and rows labeled with Data 4 values. The D3/D4 pair from the example above in Figure 3, 97/85, is found on page 27 of the table and represents sequence number 8345, (See example 1 on the table). The PC software (DOS format) allows the user to enter a D3/D4 pair and the computer then determines the sequence number.

Methods for Filing Sequential CWTs

Use of Sequential CWTs requires saving and filing reference tags in order to accurately interpret tags recovered from fish. This is necessary because the tags are cut without regard to the alignment of the code pattern. Filing two tags, one immediately before and one immediately after the implant, is required for identifying individuals with 1.0 mm tags. This is a three-tag sequence -- file tag, implant tag, file tag -- and then the sequence is repeated, as shown below (note that there are two filed tags between any but the last implant): file tag/implant tag/file tag/file tag/implant tag/file tag/file tag/implant tag/

Similarly, only two reference tags are required to identify a specific *group* of fish as shown below: file tag/implant one tag per fish in the group/file tag/file tag/implant one tag per fish in the group/file tag/

Use of 1.5 mm tags simplifies the process by requiring only one reference tag per implant. This can be either the tag before or the tag after the implant tag, provided the sequence is consistent throughout the tagging process. The importance of maintaining proper order during application cannot be stressed enough. The tagger and data recorder must maintain a high level of concentration and coordination. If one step in the application procedure is skipped and not corrected, much of the following data can be lost or useless. It is beneficial for the tagger and data recorder to confer regularly to assure that they are on the same line of data.

Various techniques are available for storing reference tags including tape, glass/plastic vials, small envelopes, etc. *Unerring organization of reference tags at the time of application is required.* Reference tags can also be stored in silicone strips that are adhered to sheets of waterproof paper available from NMT. The tags are easily injected into the silicone and are visible and secure. One form is used for tagging individual fish, (fig. 4), and another form is more convenient when tagging small groups of fish, (fig. 5).

A complication arises when attempting to use this tag filing method with head molds commonly used for tagging salmonids: silicone strips don't fit. An option is to use a needle support tube in place of a head mold. Although additional care must be taken to properly locate implants, this method is convenient for filing, and has been remarkably efficient with various species.

Identifying the Specimen in the Data

Here is an example of how the process works for the identification of an individual specimen:

The reference tags on the silicone strips can be read at any time while waiting for the recovery of tagged specimens. The tags are easily removed from the silicone strip with a scalpel or sharp knife. A magnet is beneficial to have at hand while reading tags in case one is dropped. All the reference tags need not be read at this time - read only the first and last pair of each Strip so that a range of sequence numbers can be defined for that strip.

The recovered tags are temporarily stored in a manner to prevent loss of the tag and to prevent disassociation of information that was collected pertaining to the specimen. Once the recovered tags sequence number is determined, the correct reference strip can easily be found. The proper placement on the reference strip corresponds to the exact line of original data for that specimen.

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Tel: 360-468-3375 Fax: 360-468-3844
Revised 8/95

D4\D3	96	97	98	99	100
64	8319	8320	8576	8575	9088
65	8318	8321	8577	8574	9089
66	8316	8323	8579	8572	9091
67	8317	8322	8578	8573	9090
68	8312	8327	8583	8568	9095

Example 1. Table of Sequence Numbers – D3 values represent the columns and D4 values the rows. For D3 = 97 and D4 = 66, the sequence number is 8323. This example represents one section of a page of a 32-page table.

Appendix 4. -Number of coho salmon smolts caught and coded-wire tagged at Auke Creek, weir and fishery recovery of tagged fish, and ocean survival of tagged fish separated by day and into four length categories. Survival is for tagged smolts by year, day, and size at smolt migration. Adult recoveries are from expanded weir and fishery recoveries combined.

			Tagged Recovery			Ocean survival			
Date	Size Group (mm)	No. Smolts Tagged	Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	Total Survival
5-10-93	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	16	0	10	9	0.00	0.63	0.56	1.19
	111-125	70	6	10	7	0.09	0.14	0.10	0.33
	> 125	73	37	10	14	0.51	0.14	0.19	0.84
5-11-93	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	0	0	0.00	0.00	0.00	0.00
	111-125	37	3	0	4	0.08	0.00	0.11	0.19
	> 125	60	9	40	14	0.15	0.67	0.23	1.05
5-12-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	10	0	10	0	0.00	1.00	0.00	1.00
	111-125	59	9	0	8	0.15	0.00	0.14	0.29
	> 125	70	37	0	14	0.53	0.00	0.20	0.73
5-13-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	6	0	3	0.55	0.00	0.27	0.82
	111-125	94	6	40	8	0.06	0.43	0.09	0.57
	> 125	137	34	50	12	0.25	0.36	0.09	0.70
5-14-93	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	25	3	0	3	0.12	0.00	0.12	0.24
	111-125	111	6	30	3	0.05	0.27	0.03	0.35
	> 125	159	31	40	22	0.19	0.25	0.14	0.58
5-15-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	37	3	0	5	0.08	0.00	0.14	0.22
	111-125	135	34	30	25	0.25	0.22	0.19	0.66
	> 125	237	69	30	32	0.29	0.13	0.14	0.55
5-16-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	114	0	10	12	0.00	0.09	0.11	0.19
	111-125	424	34	70	77	0.08	0.17	0.18	0.43
	> 125	433	94	89	75	0.22	0.21	0.17	0.60
5-17-93	< 90	9	0	0	5	0.00	0.00	0.56	0.56
	90-110	246	12	30	84	0.05	0.12	0.34	0.51
	111-125	653	100	109	103	0.15	0.17	0.16	0.48
	> 125	455	109	89	38	0.24	0.20	0.08	0.52
5-18-93	< 90	9	0	0	0	0.00	0.00	0.00	0.00
	90-110	124	0	0	12	0.00	0.00	0.10	0.10
	111-125	255	34	40	30	0.13	0.16	0.12	0.41
	> 125	240	31	50	41	0.13	0.21	0.17	0.51
5-19-93	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	104	0	20	30	0.00	0.19	0.29	0.48
	111-125	162	16	0	24	0.10	0.00	0.15	0.25
	> 125	156	19	30	26	0.12	0.19	0.17	0.48
5-20-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	36	3	0	13	0.08	0.00	0.36	0.44
	111-125	141	12	30	30	0.09	0.21	0.21	0.51
	> 125	221	31	50	67	0.14	0.23	0.30	0.67

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Appendix 4.-Page 2 of 21.

Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
5-21-93	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	90	0	0	16	0.00	0.00	0.18	0.18
	111-125	187	3	20	41	0.02	0.11	0.22	0.34
	> 125	146	28	10	42	0.19	0.07	0.29	0.55
5-22-93	< 90	2	0	0	5	0.00	0.00	2.50	2.50
	90-110	142	0	10	14	0.00	0.07	0.10	0.17
	111-125	200	9	40	36	0.05	0.20	0.18	0.43
	> 125	147	9	20	25	0.06	0.14	0.17	0.37
5-23-93	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	106	0	0	38	0.00	0.00	0.36	0.36
	111-125	114	0	10	22	0.00	0.09	0.19	0.28
	> 125	92	3	20	22	0.03	0.22	0.24	0.49
5-24-93	< 90	1	0	10	0	0.00	10.00	0.00	10.00
	90-110	69	0	10	8	0.00	0.14	0.12	0.26
	111-125	74	3	10	14	0.04	0.14	0.19	0.36
	> 125	35	0	0	14	0.00	0.00	0.40	0.40
5-25-93	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	51	0	0	0	0.00	0.00	0.00	0.00
	111-125	64	3	20	9	0.05	0.31	0.14	0.50
	> 125	39	3	10	12	0.08	0.26	0.31	0.64
5-26-93	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	54	3	10	7	0.06	0.19	0.13	0.37
	111-125	115	0	30	26	0.00	0.26	0.23	0.49
	> 125	34	0	20	32	0.00	0.59	0.94	1.53
5-27-93	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	64	0	10	9	0.00	0.16	0.14	0.30
	111-125	121	0	0	51	0.00	0.00	0.42	0.42
	> 125	24	3	20	11	0.13	0.83	0.46	1.42
5-28-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	56	3	0	4	0.05	0.00	0.07	0.13
	111-125	55	0	0	12	0.00	0.00	0.22	0.22
	> 125	9	0	0	0	0.00	0.00	0.00	0.00
5-29-93	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	46	0	20	14	0.00	0.43	0.30	0.74
	111-125	61	0	0	18	0.00	0.00	0.30	0.30
	> 125	31	0	0	4	0.00	0.00	0.13	0.13
5-30-93	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	57	0	20	5	0.00	0.35	0.09	0.44
	111-125	58	3	10	12	0.05	0.17	0.21	0.43
	> 125	4	0	0	0	0.00	0.00	0.00	0.00
5-31-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	48	0	0	3	0.00	0.00	0.06	0.06
	111-125	44	0	0	4	0.00	0.00	0.09	0.09
	> 125	4	0	0	0	0.00	0.00	0.00	0.00
6-1-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	45	0	0	5	0.00	0.00	0.11	0.11
	111-125	29	0	0	4	0.00	0.00	0.14	0.14
	> 125	4	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery			Ocean survival, %			Total Survival
			Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	
6-2-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	0	0	0.00	0.00	0.00	0.00
	111-125	21	0	0	4	0.00	0.00	0.19	0.19
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-3-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-4-93	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	8	0.00	0.00	0.73	0.73
	111-125	9	0	0	9	0.00	0.00	1.00	1.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-5-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-6-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	10	1	0.00	1.25	0.13	1.38
	111-125	10	0	0	3	0.00	0.00	0.30	0.30
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-7-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	15	3	0	4	0.20	0.00	0.27	0.47
	111-125	22	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	3	0	0	1.50	0.00	0.00	1.50
6-8-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	0	0.00	0.00	0.00	0.00
	111-125	17	0	0	0	0.00	0.00	0.00	0.00
	> 125	4	0	0	0	0.00	0.00	0.00	0.00
6-9-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	5	0	0	0	0.00	0.00	0.00	0.00
	111-125	8	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-10-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-11-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-12-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-13-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
6-13-93	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-14-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery: Jacks Weir	Tagged Recovery: Adults Weir	Tagged Recovery: Adults Fishery	Ocean survival, %: Jacks Weir	Ocean survival, %: Adults Weir	Ocean survival, %: Adults Fishery	Total Survival
6-14-93	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-15-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-16-93	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
5-4-94	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	22	0	0	0	0.00	0.00	0.00	0.00
	111-125	39	0	0	0	0.00	0.00	0.00	0.00
	> 125	21	0	0	0	0.00	0.00	0.00	0.00
5-5-94	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00
	111-125	15	0	0	0	0.00	0.00	0.00	0.00
	> 125	13	0	0	0	0.00	0.00	0.00	0.00
5-6-94	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	10	0	0.00	0.56	0.00	0.56
	111-125	37	2	0	0	0.05	0.00	0.00	0.05
	> 125	13	0	0	0	0.00	0.00	0.00	0.00
5-7-94	< 90	9	0	0	0	0.00	0.00	0.00	0.00
	90-110	16	0	0	0	0.00	0.00	0.00	0.00
	111-125	38	2	21	0	0.05	0.55	0.00	0.61
	> 125	22	0	0	0	0.00	0.00	0.00	0.00
5-8-94	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	22	0	0	5	0.00	0.00	0.23	0.23
	111-125	61	0	0	13	0.00	0.00	0.21	0.21
	> 125	53	5	0	0	0.09	0.00	0.00	0.09
5-9-94	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	25	0	10	6	0.00	0.40	0.24	0.64
	111-125	68	2	0	9	0.03	0.00	0.13	0.16
	> 125	45	2	0	4	0.04	0.00	0.09	0.13
5-10-94	< 90	4	0	0	0	0.00	0.00	0.00	0.00
	90-110	43	0	10	10	0.00	0.23	0.23	0.47
	111-125	115	5	21	10	0.04	0.18	0.09	0.31
	> 125	98	24	21	5	0.24	0.21	0.05	0.51
5-11-94	< 90	4	0	0	0	0.00	0.00	0.00	0.00
	90-110	84	2	0	4	0.02	0.00	0.05	0.07
	111-125	274	12	10	11	0.04	0.04	0.04	0.12
	> 125	178	27	10	17	0.15	0.06	0.10	0.30
5-12-94	< 90	8	0	0	0	0.00	0.00	0.00	0.00
	90-110	69	5	21	3	0.07	0.30	0.04	0.42
	111-125	156	5	0	5	0.03	0.00	0.03	0.06
	> 125	108	13	10	5	0.12	0.09	0.05	0.26
5-13-94	< 90	15	0	0	0	0.00	0.00	0.00	0.00
	90-110	152	0	10	9	0.00	0.07	0.06	0.13
	111-125	333	7	21	15	0.02	0.06	0.05	0.13
	> 125	218	17	10	10	0.08	0.05	0.05	0.17

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery			Ocean survival, %			
			Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	Total Survival
5-14-94	< 90	8	0	0	0	0.00	0.00	0.00	0.00
	90-110	84	0	31	5	0.00	0.37	0.06	0.43
	111-125	129	7	10	3	0.05	0.08	0.02	0.16
	> 125	95	14	10	0	0.15	0.11	0.00	0.25
5-15-94	< 90	18	0	0	0	0.00	0.00	0.00	0.00
	90-110	130	0	0	0	0.00	0.00	0.00	0.00
	111-125	263	2	0	5	0.01	0.00	0.02	0.03
	> 125	185	7	0	10	0.04	0.00	0.05	0.09
5-16-94	< 90	15	0	0	0	0.00	0.00	0.00	0.00
	90-110	120	0	10	10	0.00	0.08	0.08	0.17
	111-125	224	5	10	18	0.02	0.04	0.08	0.15
	> 125	155	11	10	8	0.07	0.06	0.05	0.19
5-17-94	< 90	13	0	0	0	0.00	0.00	0.00	0.00
	90-110	137	0	10	0	0.00	0.07	0.00	0.07
	111-125	248	2	10	10	0.01	0.04	0.04	0.09
	> 125	165	5	0	3	0.03	0.00	0.02	0.05
5-18-94	< 90	12	0	0	0	0.00	0.00	0.00	0.00
	90-110	175	0	10	8	0.00	0.06	0.05	0.10
	111-125	251	5	31	5	0.02	0.12	0.02	0.16
	> 125	140	5	10	10	0.04	0.07	0.07	0.18
5-19-94	< 90	15	0	0	3	0.00	0.00	0.20	0.20
	90-110	88	0	0	5	0.00	0.00	0.06	0.06
	111-125	93	0	0	3	0.00	0.00	0.03	0.03
	> 125	59	5	10	3	0.08	0.17	0.05	0.31
5-20-94	< 90	17	0	0	0	0.00	0.00	0.00	0.00
	90-110	123	3	10	4	0.02	0.08	0.03	0.14
	111-125	80	2	21	10	0.03	0.26	0.13	0.41
	> 125	37	5	0	24	0.14	0.00	0.65	0.78
5-21-94	< 90	29	0	0	0	0.00	0.00	0.00	0.00
	90-110	155	0	0	6	0.00	0.00	0.04	0.04
	111-125	130	0	0	9	0.00	0.00	0.07	0.07
	> 125	52	0	0	8	0.00	0.00	0.15	0.15
5-22-94	< 90	13	0	0	0	0.00	0.00	0.00	0.00
	90-110	94	2	10	11	0.02	0.11	0.12	0.24
	111-125	44	0	0	0	0.00	0.00	0.00	0.00
	> 125	14	0	0	0	0.00	0.00	0.00	0.00
5-23-94	< 90	23	0	0	0	0.00	0.00	0.00	0.00
	90-110	109	2	10	9	0.02	0.09	0.08	0.19
	111-125	43	0	0	0	0.00	0.00	0.00	0.00
	> 125	23	0	0	0	0.00	0.00	0.00	0.00
5-24-94	< 90	9	0	0	0	0.00	0.00	0.00	0.00
5-24-94	90-110	60	0	0	9	0.00	0.00	0.15	0.15
	111-125	18	0	0	0	0.00	0.00	0.00	0.00
	> 125	7	0	0	0	0.00	0.00	0.00	0.00
5-25-94	< 90	17	0	0	0	0.00	0.00	0.00	0.00
	90-110	92	0	21	9	0.00	0.23	0.10	0.33
	111-125	37	0	10	10	0.00	0.27	0.27	0.54
	> 125	23	0	0	0	0.00	0.00	0.00	0.00
5-26-94	< 90	17	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
5-26-94	90-110	109	0	0	5	0.00	0.00	0.05	0.05
	111-125	43	0	0	8	0.00	0.00	0.19	0.19
	> 125	22	0	0	5	0.00	0.00	0.23	0.23
5-27-94	< 90	16	0	0	0	0.00	0.00	0.00	0.00
	90-110	72	0	10	3	0.00	0.14	0.04	0.18
	111-125	19	0	10	0	0.00	0.53	0.00	0.53
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
5-28-94	< 90	14	0	0	0	0.00	0.00	0.00	0.00
	90-110	63	0	0	0	0.00	0.00	0.00	0.00
	111-125	8	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
5-29-94	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	35	0	10	0	0.00	0.29	0.00	0.29
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	5	0	0	0	0.00	0.00	0.00	0.00
5-30-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	20	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
5-31-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-1-94	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	31	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-2-94	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	20	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-3-94	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	25	0	0	0	0.00	0.00	0.00	0.00
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-4-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	26	0	0	3	0.00	0.00	0.12	0.12
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-5-94	< 90	1	0	0	0	0.00	0.00	0.00	0.00
6-5-94	90-110	21	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-6-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	12	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-7-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	24	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00

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Appendix 4.-Page 7 of 21.

Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, % Jacks Weir	Adults Weir	Adults Fishery	Total Survival
6-7-94	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-8-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	17	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-9-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	14	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-10-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	10	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-11-94	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	37	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-12-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-13-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-14-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-15-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-16-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-17-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
6-17-94	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-18-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-19-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery: Jacks Weir	Tagged Recovery: Adults Weir	Tagged Recovery: Adults Fishery	Ocean survival, %: Jacks Weir	Ocean survival, %: Adults Weir	Ocean survival, %: Adults Fishery	Total Survival
6-20-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-21-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-22-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-23-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-24-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-25-94	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
5-9-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	7	0	0	0	0.00	0.00	0.00	0.00
	111-125	16	0	0	5	0.00	0.00	0.31	0.31
	> 125	19	8	0	4	0.42	0.00	0.21	0.63
5-10-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00
	111-125	10	0	0	0	0.00	0.00	0.00	0.00
	> 125	36	8	0	7	0.22	0.00	0.19	0.42
5-11-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	0	8	0.00	0.00	0.44	0.44
	111-125	70	3	9	7	0.04	0.13	0.10	0.27
	> 125	53	6	9	2	0.11	0.17	0.04	0.32
5-12-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	42	0	0	8	0.00	0.00	0.19	0.19
	111-125	112	11	18	30	0.10	0.16	0.27	0.53
	> 125	113	17	23	10	0.15	0.20	0.09	0.44
5-13-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	33	0	5	0	0.00	0.15	0.00	0.15
	111-125	119	14	23	7	0.12	0.19	0.06	0.37
	> 125	109	25	23	20	0.23	0.21	0.18	0.62
5-14-95	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	24	0	5	0	0.00	0.21	0.00	0.21
	111-125	112	0	18	67	0.00	0.16	0.60	0.76
	> 125	120	19	18	13	0.16	0.15	0.11	0.42
5-15-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	39	0	0	4	0.00	0.00	0.10	0.10

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
5-15-95	111-125	211	6	27	61	0.03	0.13	0.29	0.45
	> 125	173	14	18	11	0.08	0.10	0.06	0.25
5-16-95	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	62	3	5	4	0.05	0.08	0.06	0.19
	111-125	211	19	27	15	0.09	0.13	0.07	0.29
	> 125	135	14	32	26	0.10	0.24	0.19	0.53
5-17-95	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	55	0	14	4	0.00	0.25	0.07	0.33
	111-125	198	8	23	42	0.04	0.12	0.21	0.37
	> 125	148	25	9	27	0.17	0.06	0.18	0.41
5-18-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	45	0	0	3	0.00	0.00	0.07	0.07
	111-125	112	6	14	22	0.05	0.13	0.20	0.38
	> 125	84	3	14	15	0.04	0.17	0.18	0.38
5-19-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	25	0	5	3	0.00	0.20	0.12	0.32
	111-125	79	0	5	3	0.00	0.06	0.04	0.10
	> 125	51	6	5	14	0.12	0.10	0.27	0.49
5-20-95	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	53	0	0	8	0.00	0.00	0.15	0.15
	111-125	116	3	5	3	0.03	0.04	0.03	0.09
	> 125	72	6	9	17	0.08	0.13	0.24	0.44
5-21-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	28	0	5	3	0.00	0.18	0.11	0.29
	111-125	86	0	5	0	0.00	0.06	0.00	0.06
	> 125	75	11	5	23	0.15	0.07	0.31	0.52
5-22-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	27	0	0	0	0.00	0.00	0.00	0.00
	111-125	83	0	14	10	0.00	0.17	0.12	0.29
	> 125	60	11	5	12	0.18	0.08	0.20	0.47
5-23-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	55	0	0	3	0.00	0.00	0.05	0.05
	111-125	99	3	9	15	0.03	0.09	0.15	0.27
	> 125	62	3	9	1	0.05	0.15	0.02	0.21
5-24-95	< 90	3	0	0	0	0.00	0.00	0.00	0.00
5-24-95	90-110	73	0	0	0	0.00	0.00	0.00	0.00
	111-125	109	0	27	12	0.00	0.25	0.11	0.36
	> 125	35	0	0	8	0.00	0.00	0.23	0.23
5-25-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	48	0	0	0	0.00	0.00	0.00	0.00
	111-125	54	3	0	5	0.06	0.00	0.09	0.15
	> 125	31	0	9	8	0.00	0.29	0.26	0.55
5-26-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	26	0	0	0	0.00	0.00	0.00	0.00
	111-125	45	0	9	7	0.00	0.20	0.16	0.36
	> 125	11	3	5	3	0.27	0.45	0.27	1.00
5-27-95	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	28	0	0	0	0.00	0.00	0.00	0.00
	111-125	24	0	9	0	0.00	0.38	0.00	0.38
	> 125	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery: Jacks Weir	Tagged Recovery: Adults Weir	Tagged Recovery: Adults Fishery	Ocean survival, %: Jacks Weir	Ocean survival, %: Adults Weir	Ocean survival, %: Adults Fishery	Total Survival
5-28-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	67	0	5	0	0.00	0.07	0.00	0.07
	111-125	76	3	9	10	0.04	0.12	0.13	0.29
	> 125	22	3	5	0	0.14	0.23	0.00	0.36
5-29-95	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	37	0	0	0	0.00	0.00	0.00	0.00
	111-125	37	0	5	3	0.00	0.14	0.08	0.22
	> 125	7	0	0	0	0.00	0.00	0.00	0.00
5-30-95	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	53	0	0	0	0.00	0.00	0.00	0.00
	111-125	38	3	0	4	0.08	0.00	0.11	0.18
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
5-31-95	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	51	0	0	4	0.00	0.00	0.08	0.08
	111-125	30	3	0	7	0.10	0.00	0.23	0.33
	> 125	8	0	9	0	0.00	1.13	0.00	1.13
6-1-95	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	32	0	0	0	0.00	0.00	0.00	0.00
	111-125	19	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-2-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	23	0	5	0	0.00	0.22	0.00	0.22
	111-125	21	0	0	3	0.00	0.00	0.14	0.14
	> 125	2	0	0	3	0.00	0.00	1.50	1.50
6-3-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	0	0	0.00	0.00	0.00	0.00
	111-125	13	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-4-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	16	0	0	0	0.00	0.00	0.00	0.00
	111-125	18	0	0	0	0.00	0.00	0.00	0.00
	> 125	5	0	0	0	0.00	0.00	0.00	0.00
6-5-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
6-5-95	90-110	13	0	0	0	0.00	0.00	0.00	0.00
	111-125	10	0	0	3	0.00	0.00	0.30	0.30
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-6-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	12	0	4	0	0.00	0.33	0.00	0.33
	111-125	13	0	0	0	0.00	0.00	0.00	0.00
	> 125	3	0	0	0	0.00	0.00	0.00	0.00
6-7-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-8-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	15	0	0	3	0.00	0.00	0.20	0.20
6-5-95	90-110	13	0	0	0	0.00	0.00	0.00	0.00
	111-125	10	0	0	3	0.00	0.00	0.30	0.30
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-6-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recolvery Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, % Jacks Weir	Adults Weir	Adults Fishery	Total Survival
6-6-95	111-125	11	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-9-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	12	0	0	0	0.00	0.00	0.00	0.00
	111-125	29	0	0	3	0.00	0.00	0.10	0.10
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-10-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	8	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-11-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
6-12-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	14	0	4	0	0.00	0.29	0.00	0.29
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-13-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-14-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	9	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-15-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	7	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-16-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	4	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-17-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
6-17-95	90-110	5	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-18-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-19-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-20-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
6-21-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-22-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-23-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-24-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-25-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-26-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-27-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-28-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-29-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
6-29-95	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-30-95	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
5-8-96	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	0	0.00	0.00	0.00	0.00
	111-125	18	0	0	0	0.00	0.00	0.00	0.00
	> 125	35	5	9	3	0.14	0.26	0.09	0.49
5-9-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	7	0	0	0	0.00	0.00	0.00	0.00
	> 125	7	0	5	0	0.00	0.71	0.00	0.71
5-10-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery: Jacks Weir	Tagged Recovery: Adults Weir	Tagged Recovery: Adults Fishery	Ocean survival, %: Jacks Weir	Ocean survival, %: Adults Weir	Ocean survival, %: Adults Fishery	Total Survival
5-10-96	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	13	0	5	0	0.00	0.38	0.00	0.38
	> 125	30	10	9	0	0.33	0.30	0.00	0.63
5-11-96	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	5	0	5	0	0.00	1.00	0.00	1.00
	111-125	37	0	5	3	0.00	0.14	0.08	0.22
	> 125	49	10	0	0	0.20	0.00	0.00	0.20
5-12-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	6	0	0	0	0.00	0.00	0.00	0.00
	111-125	26	0	5	0	0.00	0.19	0.00	0.19
	> 125	69	10	23	7	0.14	0.33	0.10	0.58
5-13-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	10	0	5	0	0.00	0.50	0.00	0.50
	111-125	32	5	5	5	0.16	0.16	0.16	0.47
	> 125	66	14	23	4	0.21	0.35	0.06	0.62
5-14-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	23	0	5	0	0.00	0.22	0.00	0.22
	111-125	100	5	36	1	0.05	0.36	0.01	0.42
	> 125	180	14	23	7	0.08	0.13	0.04	0.24
5-15-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	37	0	9	0	0.00	0.24	0.00	0.24
	111-125	112	5	41	13	0.04	0.37	0.12	0.53
	> 125	126	7	5	0	0.06	0.04	0.00	0.10
5-16-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	45	0	0	11	0.00	0.00	0.24	0.24
	111-125	88	5	5	0	0.06	0.06	0.00	0.11
	> 125	98	14	18	3	0.14	0.18	0.03	0.36
5-17-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	66	5	14	1	0.08	0.21	0.02	0.30
	111-125	135	10	18	5	0.07	0.13	0.04	0.24
	> 125	168	12	36	9	0.07	0.21	0.05	0.34
5-18-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
5-18-96	90-110	47	2	9	7	0.04	0.19	0.15	0.38
	111-125	122	7	23	9	0.06	0.19	0.07	0.32
	> 125	120	2	18	5	0.02	0.15	0.04	0.21
5-19-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	28	0	9	0	0.00	0.32	0.00	0.32
	111-125	36	0	14	4	0.00	0.39	0.11	0.50
	> 125	24	0	0	0	0.00	0.00	0.00	0.00
5-20-96	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	51	0	9	1	0.00	0.18	0.02	0.20
	111-125	80	2	9	7	0.03	0.11	0.09	0.23
	> 125	90	10	27	0	0.11	0.30	0.00	0.41
5-21-96	< 90	4	0	0	0	0.00	0.00	0.00	0.00
	90-110	78	0	5	4	0.00	0.06	0.05	0.12
	111-125	82	2	5	3	0.02	0.06	0.04	0.12
	> 125	41	2	9	0	0.05	0.22	0.00	0.27
5-22-96	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	50	0	9	0	0.00	0.18	0.00	0.18

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Appendix 4.-Page 14 of 21.

Date	Size Group (mm)	No. Smolts Tagged	Tagged Recov1ery Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, % Jacks Weir	Adults Weir	Adults Fishery	Total Survival
5-22-96	111-125	55	2	0	0	0.04	0.00	0.00	0.04
	> 125	29	0	0	0	0.00	0.00	0.00	0.00
5-23-96	< 90	8	0	0	4	0.00	0.00	0.50	0.50
	90-110	86	0	14	3	0.00	0.16	0.03	0.20
	111-125	48	0	27	5	0.00	0.56	0.10	0.67
	> 125	30	0	9	0	0.00	0.30	0.00	0.30
5-24-96	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	48	0	14	0	0.00	0.29	0.00	0.29
	111-125	34	0	5	4	0.00	0.15	0.12	0.26
	> 125	25	2	0	0	0.08	0.00	0.00	0.08
5-25-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	56	0	5	0	0.00	0.09	0.00	0.09
	111-125	18	0	9	0	0.00	0.50	0.00	0.50
	> 125	12	0	0	0	0.00	0.00	0.00	0.00
5-26-96	< 90	7	0	0	0	0.00	0.00	0.00	0.00
	90-110	78	0	9	0	0.00	0.12	0.00	0.12
	111-125	29	0	9	0	0.00	0.31	0.00	0.31
	> 125	13	0	5	0	0.00	0.38	0.00	0.38
5-27-96	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	63	0	0	0	0.00	0.00	0.00	0.00
	111-125	29	0	0	0	0.00	0.00	0.00	0.00
	> 125	9	0	0	0	0.00	0.00	0.00	0.00
5-28-96	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	65	0	5	0	0.00	0.08	0.00	0.08
	111-125	31	0	9	0	0.00	0.29	0.00	0.29
	> 125	15	0	0	0	0.00	0.00	0.00	0.00
5-29-96	< 90	5	0	0	3	0.00	0.00	0.60	0.60
	90-110	50	0	0	0	0.00	0.00	0.00	0.00
	111-125	26	0	5	4	0.00	0.19	0.15	0.35
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
5-30-96	< 90	18	0	0	0	0.00	0.00	0.00	0.00
	90-110	61	0	5	9	0.00	0.08	0.15	0.23
	111-125	29	0	5	0	0.00	0.17	0.00	0.17
	> 125	4	0	0	0	0.00	0.00	0.00	0.00
5-31-96	< 90	7	0	0	0	0.00	0.00	0.00	0.00
	90-110	48	0	5	3	0.00	0.10	0.06	0.17
	111-125	22	2	5	0	0.09	0.23	0.00	0.32
	> 125	7	0	0	0	0.00	0.00	0.00	0.00
6-1-96	< 90	12	0	0	0	0.00	0.00	0.00	0.00
	90-110	47	0	9	0	0.00	0.19	0.00	0.19
	111-125	27	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
6-2-96	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	0	0	0.00	0.00	0.00	0.00
	111-125	6	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-3-96	< 90	6	0	0	0	0.00	0.00	0.00	0.00
	90-110	16	0	0	0	0.00	0.00	0.00	0.00
	111-125	10	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, % Jacks Weir	Adults Weir	Adults Fishery	Total Survival
6-3-96	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-4-96	< 90	3	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	5	0	0.00	0.63	0.00	0.63
	111-125	4	2	0	0	0.50	0.00	0.00	0.50
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-5-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	20	0	0	0	0.00	0.00	0.00	0.00
	111-125	8	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-6-96	< 90	4	0	0	0	0.00	0.00	0.00	0.00
	90-110	26	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-7-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	4	0.00	0.00	0.36	0.36
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-8-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-9-96	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	10	0	0	5	0.00	0.00	0.50	0.50
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-10-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-11-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	5	0	0.00	2.50	0.00	2.50
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-12-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	15	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-13-96	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	14	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-14-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	7	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-15-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, % Jacks Weir	Adults Weir	Adults Fishery	Total Survival
6-16-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-17-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-18-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-19-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-20-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	2	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-21-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-22-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-23-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-24-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-25-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-26-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-27-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-28-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery			Ocean survival, %			Total Survival
			Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	
6-28-96	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-29-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-30-96	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
5-6-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
5-7-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
5-8-97	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	5	0	0	0	0.00	0.00	0.00	0.00
5-9-97	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	5	0	0	0	0.00	0.00	0.00	0.00
	111-125	11	0	0	0	0.00	0.00	0.00	0.00
	> 125	12	6	0	3	0.50	0.00	0.25	0.75
5-10-97	< 90	5	0	0	0	0.00	0.00	0.00	0.00
5-10-97	90-110	6	0	0	0	0.00	0.00	0.00	0.00
	111-125	10	0	17	0	0.00	1.70	0.00	1.70
	> 125	21	13	17	3	0.62	0.81	0.14	1.57
5-11-97	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	0	0	0.00	0.00	0.00	0.00
	111-125	9	3	0	0	0.33	0.00	0.00	0.33
	> 125	13	6	0	0	0.46	0.00	0.00	0.46
5-12-97	< 90	14	0	0	0	0.00	0.00	0.00	0.00
	90-110	15	0	0	0	0.00	0.00	0.00	0.00
	111-125	21	3	17	12	0.14	0.81	0.57	1.52
	> 125	34	10	17	0	0.29	0.50	0.00	0.79
5-13-97	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	9	0	0	0	0.00	0.00	0.00	0.00
	111-125	38	3	34	3	0.08	0.89	0.08	1.05
	> 125	69	13	0	4	0.19	0.00	0.06	0.25
5-14-97	< 90	16	0	0	0	0.00	0.00	0.00	0.00
	90-110	41	0	0	14	0.00	0.00	0.34	0.34
	111-125	143	0	17	17	0.00	0.12	0.12	0.24
	> 125	208	42	17	26	0.20	0.08	0.13	0.41
5-15-97	< 90	37	0	0	0	0.00	0.00	0.00	0.00
	90-110	86	0	17	14	0.00	0.20	0.16	0.36

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery: Jacks Weir	Adults Weir	Adults Fishery	Ocean survival, %: Jacks Weir	Adults Weir	Adults Fishery	Total Survival
5-15-97	111-125	145	16	86	7	0.11	0.59	0.05	0.75
	> 125	206	51	52	31	0.25	0.25	0.15	0.65
5-16-97	< 90	28	0	0	0	0.00	0.00	0.00	0.00
	90-110	55	0	0	0	0.00	0.00	0.00	0.00
	111-125	80	6	52	4	0.08	0.65	0.05	0.78
	> 125	96	16	0	14	0.17	0.00	0.15	0.31
5-17-97	< 90	30	0	0	0	0.00	0.00	0.00	0.00
	90-110	76	3	0	4	0.04	0.00	0.05	0.09
	111-125	191	6	34	10	0.03	0.18	0.05	0.26
	> 125	332	71	34	32	0.21	0.10	0.10	0.41
5-18-97	< 90	9	0	0	0	0.00	0.00	0.00	0.00
	90-110	32	0	0	0	0.00	0.00	0.00	0.00
	111-125	118	0	17	7	0.00	0.14	0.06	0.20
	> 125	147	13	52	29	0.09	0.35	0.20	0.64
5-19-97	< 90	23	0	0	0	0.00	0.00	0.00	0.00
	90-110	65	0	0	0	0.00	0.00	0.00	0.00
	111-125	183	10	86	25	0.05	0.47	0.14	0.66
	> 125	181	19	0	3	0.10	0.00	0.02	0.12
5-20-97	< 90	19	0	0	0	0.00	0.00	0.00	0.00
	90-110	102	0	17	7	0.00	0.17	0.07	0.24
	111-125	242	0	34	36	0.00	0.14	0.15	0.29
	> 125	226	16	34	33	0.07	0.15	0.15	0.37
5-21-97	< 90	11	0	0	0	0.00	0.00	0.00	0.00
	90-110	87	0	0	11	0.00	0.00	0.13	0.13
	111-125	168	6	69	17	0.04	0.41	0.10	0.55
	> 125	152	10	52	12	0.07	0.34	0.08	0.49
5-22-97	< 90	24	0	0	4	0.00	0.00	0.17	0.17
	90-110	110	0	0	11	0.00	0.00	0.10	0.10
	111-125	176	6	17	10	0.03	0.10	0.06	0.19
	> 125	114	16	0	11	0.14	0.00	0.10	0.24
5-23-97	< 90	34	0	0	3	0.00	0.00	0.09	0.09
	90-110	113	0	17	4	0.00	0.15	0.04	0.19
	111-125	123	3	17	11	0.02	0.14	0.09	0.25
	> 125	71	3	0	3	0.04	0.00	0.04	0.08
5-24-97	< 90	18	0	0	0	0.00	0.00	0.00	0.00
	90-110	131	0	17	10	0.00	0.13	0.08	0.21
	111-125	80	0	17	18	0.00	0.21	0.23	0.44
	> 125	27	0	0	0	0.00	0.00	0.00	0.00
5-25-97	< 90	13	0	0	0	0.00	0.00	0.00	0.00
	90-110	91	0	0	5	0.00	0.00	0.05	0.05
	111-125	55	3	0	16	0.05	0.00	0.29	0.35
	> 125	27	0	0	0	0.00	0.00	0.00	0.00
5-26-97	< 90	12	0	0	0	0.00	0.00	0.00	0.00
	90-110	60	0	0	3	0.00	0.00	0.05	0.05
	111-125	25	0	0	0	0.00	0.00	0.00	0.00
	> 125	11	0	0	0	0.00	0.00	0.00	0.00
5-27-97	< 90	13	0	0	3	0.00	0.00	0.23	0.23
	90-110	74	0	0	7	0.00	0.00	0.09	0.09
	111-125	16	0	0	0	0.00	0.00	0.00	0.00
	> 125	6	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
5-28-97	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	53	0	0	13	0.00	0.00	0.25	0.25
	111-125	14	0	0	0	0.00	0.00	0.00	0.00
	> 125	6	0	0	0	0.00	0.00	0.00	0.00
5-29-97	< 90	19	0	0	4	0.00	0.00	0.21	0.21
	90-110	70	0	0	1	0.00	0.00	0.01	0.01
	111-125	14	0	0	0	0.00	0.00	0.00	0.00
	> 125	4	0	0	4	0.00	0.00	1.00	1.00
5-30-97	< 90	15	0	0	0	0.00	0.00	0.00	0.00
	90-110	105	0	0	11	0.00	0.00	0.10	0.10
	111-125	15	0	0	4	0.00	0.00	0.27	0.27
	> 125	3	0	0	0	0.00	0.00	0.00	0.00
5-31-97	< 90	9	0	0	0	0.00	0.00	0.00	0.00
	90-110	49	0	0	7	0.00	0.00	0.14	0.14
	111-125	26	0	0	0	0.00	0.00	0.00	0.00
	> 125	5	0	0	0	0.00	0.00	0.00	0.00
6-1-97	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	23	0	0	3	0.00	0.00	0.13	0.13
	111-125	24	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
6-2-97	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	36	0	0	0	0.00	0.00	0.00	0.00
	111-125	11	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-3-97	< 90	5	0	0	0	0.00	0.00	0.00	0.00
	90-110	27	0	0	0	0.00	0.00	0.00	0.00
	111-125	9	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-4-97	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	12	0	0	0	0.00	0.00	0.00	0.00
	111-125	6	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-5-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
6-6-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	8	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-7-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	17	0	0	3	0.00	0.00	0.18	0.18
	111-125	4	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-8-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	3	0.00	0.00	1.50	1.50
6-9-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	13	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Recovery Jacks Weir	Tagged Recovery Adults Weir	Tagged Recovery Adults Fishery	Ocean survival, % Jacks Weir	Ocean survival, % Adults Weir	Ocean survival, % Adults Fishery	Total Survival
6-9-97	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-10-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	18	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	3	0	0	0.60	0.00	0.00	0.60
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-11-97	< 90	2	0	0	0	0.00	0.00	0.00	0.00
	90-110	27	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-12-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	6	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-13-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-14-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	6	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-15-97	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	11	0	0	0	0.00	0.00	0.00	0.00
	111-125	5	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-16-97	< 90	1	0	0	0	0.00	0.00	0.00	0.00
	90-110	10	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-17-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	5	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-18-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	3	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-19-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	5	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00
	> 125	2	0	0	0	0.00	0.00	0.00	0.00
6-20-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	6	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	1	0	0	0	0.00	0.00	0.00	0.00
6-21-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	3	0	0	0	0.00	0.00	0.00	0.00
	111-125	2	0	0	0	0.00	0.00	0.00	0.00

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Date	Size Group (mm)	No. Smolts Tagged	Tagged Reco1very			Ocean survival, %			Total Survival
			Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	
6-21-97	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-22-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-23-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-24-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-25-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-26-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-27-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	1	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-28-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-29-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	1	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00
6-30-97	< 90	0	0	0	0	0.00	0.00	0.00	0.00
	90-110	0	0	0	0	0.00	0.00	0.00	0.00
	111-125	0	0	0	0	0.00	0.00	0.00	0.00
	> 125	0	0	0	0	0.00	0.00	0.00	0.00

Appendix 5. Historical numbers of coho salmon smolts caught and coded-wire tagged at Auke Creek, escapement of jacks and adults, weir and fishery recovery of tagged fish, ocean survival and fishery harvest of tagged fish. Survival is for tagged smolts by year of smolt migration. Averages were calculated for years when data was available. Information for the years, 1993 – 1997, of the study are in the shaded area.

	Smolts		Escapement		Tagged Fish Recovered			Ocean survival, %				
Year	Total	No. Tagged	Jacks	Adults	Jacks Weir	Adults Weir	Adults Fishery	Jacks Weir	Adults Weir	Adults Fishery	Total	Harvest Rate
1971	nd	0	608	967	0	0	nd	---	---	---	---	
1972	nd	0	146	399	0	0	nd	---	---	---	---	
1973	nd	0	238	768	0	0	nd	---	---	---	---	
1974	nd	0	379	1310	0	0	nd	---	---	---	---	
1975	nd	0	98	262	0	0	nd	---	---	---	---	
1976	nd	2992	176	868	21	246	189	0.7	8.2	6.3	15.2	43.4
1977	nd	3038	583	683	59	112	131	1.9	3.7	4.3	9.9	53.9
1978	nd	0	256	566	0	0	nd	---	---	---	---	---
1979	nd	3872	107	698	12	306	170	0.3	7.9	4.4	12.6	35.7
1980	9951	9821	276	646	226	592	330	2.3	6.0	3.4	11.7	35.8
1981	6953	6372	231	447	203	417	292	3.2	6.5	4.6	14.3	41.2
1982	6483	6245	338	694	335	630	545	5.4	10.1	8.7	24.2	46.4
1983	6634	6115	261	651	224	614	444	3.7	10.0	7.3	21.0	42.0
1984	7012	6751	315	942	304	937	741	4.5	13.9	11.0	29.4	44.2
1985	5601	5545	122	454	118	429	570	2.1	7.7	10.3	20.1	57.1
1986	5666	5502	307	668	288	668	511	5.2	12.1	9.3	26.7	43.3
1987	7166	6883	212	756	206	736	445	3.0	10.7	6.5	20.2	37.7
1988	7888	7751	412	502	406	502	604	5.2	6.5	7.8	19.5	54.6
1989	6911	6819	386	697	329	678	785	4.8	9.9	11.5	26.3	53.7
1990	5132	5020	225	820	165	808	371	3.3	16.1	7.4	26.8	31.5
1991	5764	5671	317	1020	314	1020	855	5.5	18.0	15.1	38.6	45.6
1992	6262	6106	271	859	271	774	730	4.4	12.7	12.0	29.1	48.5
1993	8103	7844	910	1437	876	1253	1618	11.2	16.0	20.6	47.8	56.4
1994	7416	7255	229	460	212	455	360	2.9	6.3	5.0	14.2	44.2
1995	4869	4798	283	515	269	515	626	5.6	10.7	13.0	29.4	54.9
1996	3962	3919	168	609	168	606	148	4.3	15.5	3.8	23.5	19.6
1997	6207	6080	381	862	376	862	538	6.2	14.2	8.8	29.2	38.4
1998	7430	7379	449	845	447	845	589	6.1	11.5	8.0	25.5	41.1
1999	5491	5123	149	683	149	666	244	2.9	13.0	4.8	20.7	26.8
2000	4891	4862	227	865	206	842	506	4.2	17.3	10.4	32.0	37.5
2001	5742	5687	153		142			2.5				
mean	6433		297	718			514	4.1	11.0	8.5	23.7	43.1

Appendix 6. Average smolt length at Auke Creek by year.

Year	Average Length (mm)	SE (mm)
1981	117	na
1982	117.5	0.59
1983	116.3	0.4
1984	112.9	0.29
1985	106.1	0.67
1986	118	0.88
1987	110.8	0.79
1988	113.9	0.53
1989	106.4	0.76
1990	111.3	0.67
1991	113	0.77
1992	120	0.44
1993	117.6	0.62
1994	113.3	0.65
1995	117.3	0.68
1996	113.1	0.7
1997	114.1	0.97
1998	118.3	0.61
1999	116	na
2000	119	0.58
2001	116	na
2002	115	na
average	114.7	3.7